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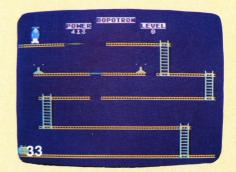
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THE MAGAZINE FOR ATARI" COMPUTER OWNERS

# FINE STATES

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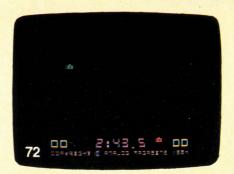




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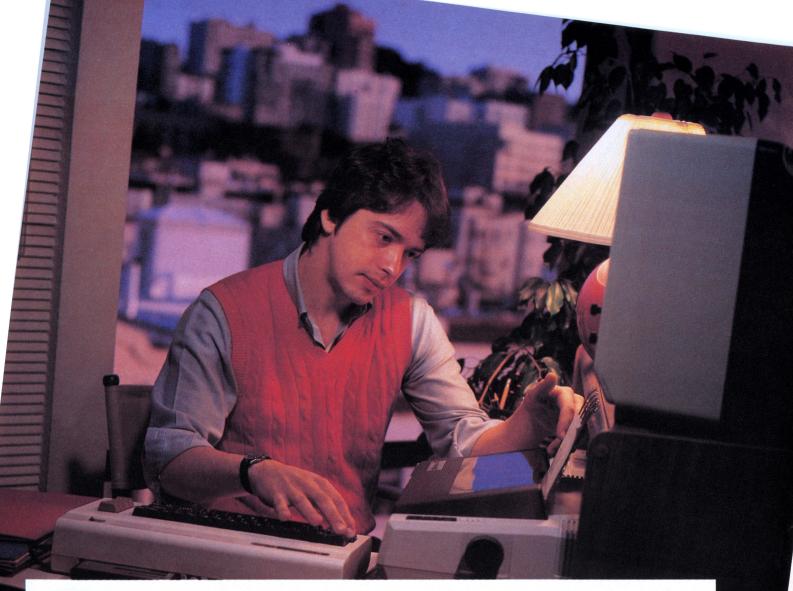
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### READER COMMENT

#### Not a BBS.

The BBS known as Software Safaris (otherwise listed as Soft Safaris or Sw. Safaris) was discontinued about one year ago, so that I might use the Atari for my own projects.

Since that time, I have seen my number published as an active BBS several times! Please don't call any of these numbers expecting a computer linkup: (405) 685-2027, 636-0218.

Thank you, Michael Ray Oklahoma City, OK

#### Ape-Face feedback.

In response to your review of the **Ape-Face** printer interface, I would like to update you on Digital Devices' product line.

Mr. Bachand evaluated one of the *very* first interfaces we ever produced, and it did have a rather unconventional picture of an ape. Now, however, the **Ape-Face** used is much more aesthetically and visually appealing.



The **Ape-Face** is now available with an extra I/O connector for daisy-chaining other peripherals, and it costs no more than the older model. Digital Devices has developed two new products which will be released soon.

One is the **U-Print**, a printer interface for Commodore machines, and the other is a low cost **Printer Buffer**, which works with the **Ape-Face**, as well as many other standard computers and printers.

Thank you for evaluating Ape-Face in ANALOG Computing.

Sincerely,

Charles L. Frazier President, Digital Devices Corp. Atlanta, GA

#### Compiling in 3-D.

I am impressed on how the 3-D image plotter (Solid States, issue 16) by Tom Hudson worked, and I have a couple questions.

First of all, I want to know how to change the Atari 1020 plotter routine to fit my Prowriter.

Second, I want to compile this program on my A.B.C. (A Basic Compiler) Compiler, but there's a square root on Lines 500 and 520. According to COMPUTE! Book's Mapping the Atari, there is a routine at \$BEB1 (48817 dec.) that will calculate the square root of the number at locations \$D4-\$D9(212-217). I tried this by taking my number (N) and doing the following steps:

10 N=1000 20 M5B=INT(M/256) 30 L5B=N-M5B\*256 40 POKE 212,L5B 50 POKE 213,M5B 60 ? USR(48817)

For some reason, this came back with ERROR - 9 or Array or String DIM Error. Is this supposed to print my answer or is it supposed to die?

Could you please show me how to use the floating point package for this application?

Thank you. Jeff Lamb Livermore, CA

If you'd like to print Solid States graphic images on your Prowriter, check out Son of Solid States in ANALOG Computing issue 22. There's also a routine to print the images on Epson printers in the same issue.

Unfortunately, the A.B.C. Compiler can't be used to compile Solid States. The three-dimensional transformation calculations require the use of floating-point values, and A.B.C. works only with integers.

The square root routine you mention is not located in the system's floating-point library, but is in the BASIC cartridge and also requires the use of floating-point values, stored in BCD (Binary Coded Decimal) format. It is not reecommended that you JSR to this routine directly, nor is it easy to do in BASIC.

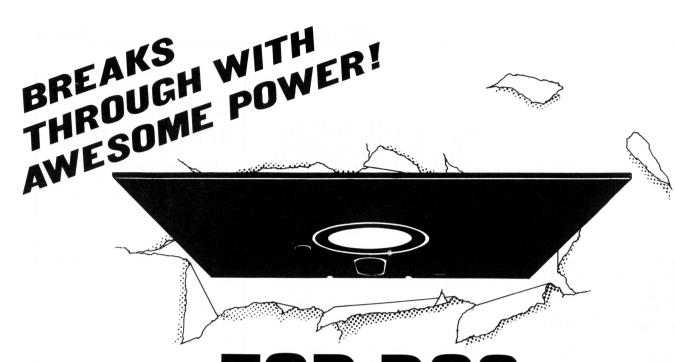
-TH

#### Remote Micro-Puzzler.

I am a great fan of Atari Graphics 7½ and have spent many hours in creating and modifying the wonderful pictures that can be produced in this mode. Consequently, I was fascinated by **Micro-Puzzler** (issue 22). Mr. Hearin is to be commended on a superb job!

My son and I spent a few hours in front of the screen attempting to piece together some of our favorite files with moderate success. Since I do spend a number of hours at the keyboard, I like to lean back and relax when I "play."

If one takes the time to key the following lines into Larry's excellent program, the joystick can be



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used from an easy chair to manipulate the pieces. The four cardinal directions will move the cursor, and the trigger takes the place of RETURN. Pull the stick away from the button, and your piece is rotated. Pushing the stick toward the button toggles the display. The keyboard response is little affected by the changes. This program is a delight!

15 DIM 5TK(15):FOR I =5 TO 15:READ A:STK( I)=A:NEXT I:DATA 40, 255,7,0,255,39,6,0,1 5,14,255 372 IF NOT STRIG(0) THEN POKE 764,12:GO TO 380 374 IF STICK(0)=15 THEN 380 376 POKE 764,STK(STICK(0)) 375 IF A=255 THEN 37

Sincerely, Chet Walters Girard, OH

#### More on Create-A-Font.

I agree with Mr. Randolf Constan (issue 18 Reader Comment) in his praise of the Create-A-Font program published in issue 16. I also noticed that the menu slowly becomes unreadable, as more and more letters are changed.

Mr. Constan's display list interrupt modification does clear that problem up nicely, but it causes difficulty elsewhere. . When one selects the data option (wherein the program displays a four-by-four grid of both normal and inverse video characters and the numeric values for each line), the characters displayed are always hearts (the values are correct for the character selected). If it would be possible to communicate this to Mr. Constan for his attention, a valuable option of the program would be rescued.

I have scheduled "Understanding Display List Interrupts" for myself too far in the future to attend to this matter myself...

Donald McEntee Webster Groves, MO

The following modifications work with those in issue 18 to allow display-

ing the characters in their modified form.

471 ITOG=0:POKE DL-19,141 472 IF PEEK(53279)=5 THEN ITOG=ITOG+1:IDELAY=100:IF ITOG>1 THEN ITOG=0:POKE DL -19,141:GOTO 474 473 IF ITOG=1 THEN POKE DL -19,13 474 IF IDELAY>0 THEN IDELA Y=IDELAY-1:GOTO 474 480 IF STRIG(C0) THEN 472 481 POKE DL-19,13

Now, when the data mode is selected, the modified characters will be shown. While in the data mode, you can toggle between character sets by pressing the SELECT key. This allows you to read the numeric characters in the data values if they have been changed. Simply add these lines to your **Create-A-Font** program (as modified in issue 18).

-TH

I am slightly confused about copyright laws on public domain software...and I'm wondering if you could help me.

If a program published in ANA-LOG Computing—or any other magazine—is copyrighted and has a good program design or efficient subroutines that can be used in other programs, is it breaking the copyright for a programmer to use those routines or general program design in his own programs if these are to be published?

I certainly would appreciate any assistance you could give me.

Chris Cammack Oviedo, FL

The best rule of thumb to follow in these cases is to contact the magazine in question. Each publisher may have a different view of how to handle this problem.

For programs from ANALOG Computing, just write us a letter, telling us which program is involved and what you plan to do with your program when it's completed. We normally only ask for written credit in the program documentation. Naturally, if you're writing the program for publication in ANALOG Computing, no permission is necessary.

-TH

## Credit where credit is due.

The stunning cover for our last issue was provided by Bruce Bennett, a Hicksville, NY-based professional photographer.

Bruce does a great deal of special effects photography, using various light effects and multiple exposures. For the cover, a standard 5½" diskette was suspended against a black background and photographed normally. A burning sparkler was positioned behind the disk and exposed several times, using different colored filters for each exposure.

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# Griffin's Lair Educational Programs Review



by Braden E. Griffin, M.D.

Procrastination is the mother of circumvention. I realize that my motto for success may not stir the hearts of men, but the light bulb has already been invented. In spite of more pressing matters—like the 23rd Olympiad and ideal golfing weather—I have managed to meet yet another deadline.

I always wondered what perverse individual was responsible for the textbook titles of yesteryear: Adventures in Math or Adventures in Civics. "Adventures in civics?" Gimme a break. The only adventure in civics was trying to stay awake. However, this month we will look at some computer adventures designed specifically for children. These games provide much in the way of educational benefits, as well as being quite entertaining. Anyway, someone here promised I would do it. Does the name Jon ring a bell?

Adventure games encourage a uniquely personal interaction with the computer. Many of them promote the development of reading skills, particularly in the area of comprehension. The logical thinking used to solve problems—an essential for success—is a prime ingredient in adventures. Every game of this genre involves a journey of sorts, and an aptitude for knowing where you are (and where you are going) is developed, since it is of prime importance. The concept of mapping out an area is basic to one's quest for the Holy Grail.

With increasing complexity, attention to detail is imperative, and note taking skills become invaluable. All in all, adventure games motivate children to develop proficiency in many areas, and mental exercise is as important as physical. I doubt that anybody will record a hit song "Let's Get Mental," but let's.

SEASTALKER INFOCOM, INC. 55 Wheeler Street Cambridge, MA 02138 40K Disk \$39.95

The first computer adventure game was created by Willie Crowther and Don Woods not far from the home of Infocom. This classic journey through Colossal Cave opened the portal to an area of computer software which has grown to unfathomable proportions.

The early adventure games were composed entirely of text, with the player initiating action through an interpreter or "puppet." Simple two-word commands, like TAKE AXE, or GO NORTH, made it possible to achieve this interaction. The unusual images created provided a unique experience for everyone. Because of the exceptional graphic capabilities of the computer, illustrated text adventures using the

basic two-word commands soon followed. Not far behind were graphic adventures controlled entirely by joystick and even action adventures, using an arcadestyle format.

The parallel to the evolution, or maybe devolution, of leisure time activities from books to television to video games (Tinkers to Evers to Chance) is interesting. It would be great if someone could refashion the rather simplistic format of the original text adventures without stifling the imagination with pictures. Enter Infocom.

Beginning with Zork I: The Great Underground Empire, Infocom introduced Interlogic machine language adventures, where one communicates in complete sentences, rather than two-word commands. The Zork trilogy and a wide variety of other scenarios from Infocom are among the most popular adventures, text or otherwise, on the market today. Following in the footsteps of this august family of interactive fictional escapades is Seastalker, written with the beginning adventurer in mind.

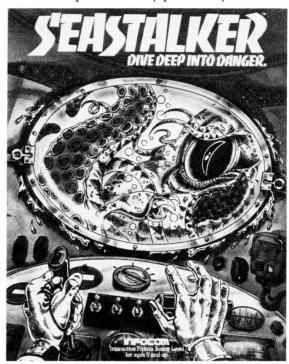
Before discussing the particulars of **Seastalker**, it is important to examine the use of what is referred to as Interlogic machine language. As mentioned earlier, communication involves the use of complete sentences. Multiple objects may be used, and more than one command may be input at a time. TURN ON THE HYDROJET THEN SET THE THROTTLE TO FAST is a valid command, with the computer executing each in order and responding in kind.

Most of the over 800 words in the game's vocabulary require correct spelling, at least of the first six letters of the word, which is what the computer recognizes. Using N for NORTH, or similar abbreviations, is permitted. When entering a room for the first time. a complete description is given, including the objects in view and visible exits. On re-entering the same room, a less extensive description is given, unless the VERBOSE command is employed to elicit the complete version (or, conversely, the SUPERBRIEF mode, which just displays the name of the room). Other frequently used commands include INVENTORY (a list of possessions), LOOK, SAVE (up to five different game locations may be saved), RESTORE (previous game position), DIAGNOSE (assesses physical condition) and WAIT (allowing time to pass). An extremely helpful feature is the SCRIPT command, which allows the use of a printer and provides a transcript of the interaction. Reviewing the conversations and descriptions from previous sessions may prevent needless duplication of effort and is always quite interesting.

Direct conversation with the characters in the story is accomplished by simply ASKing the individual ABOUT something or someone. The emphasis on the input of commands which are grammatically correct is very welcome. The computer may respond to improperly phrased commands with comments like

YOU MUST SUPPLY A VERB or I FOUND TOO MANY NOUNS IN THAT SENTENCE or even YOU CAN'T USE MULTIPLE DIRECT OBJECTS WITH ATTACK. Any game capable of improving a child's vocabulary and spelling, while stressing fundamentals of grammar, has merits far in excess of its intrinsic entertainment value.

Seastalker has been produced by the combined effort of Stu Galley (Infocom's The Witness) and Jim Lawrence. Lawrence, an author of juvenile fiction for years, has ghostwritten for series such as Nancy Drew and the Hardy Boys. The result of this collaboration is an absorbing adventure in which the characters are so well developed that they practically come to life.



Seastalker.

The story centers around the undersea research station of Inventions Unlimited, or the Aquadome, and the perils that surround it. The player assumes the role of the main character who has just developed a super submarine, the ultramarine bioceptor Scimitar, at a distant research lab. Suddenly, a message is received concerning an attack on the Aquadome by a monster of some sort—the crew there is in grave danger.

Here I come to save the day! One must pilot the previously untested sub to the Aquadome through Frobton Bay, avoiding the speedboats and ships above, as well as treacherous shoals and submerged wrecks below the surface of the water. Navigation can be tricky, but attempts at sabotage make the journey even more dangerous. Having arrived at the Aquadome, the adventure is just beginning.

A crack team of experts is available to help with the dilemma—well, maybe *some* of them have less than the most honorable intentions. I don't want to ruin the story (the good guys do not *always* win), but suffice it to say that Murphy's First Law prevails—everything seems to go wrong. The problems must be approached logically, and the crew's expertise used to solve them.

Any game, particularly a text adventure that causes sweaty palms and the feeling that one's heart is trying to exit through the throat as each command is anxiously entered, has succeeded in creating realistic interaction.

As usual, Infocom's packaging adds even more realism. Included is a submarine logbook containing scale drawings of the research lab, the Aquadome and the Scimitar, as well as serving as the user's manual. The documentation on how to play is thorough and easily understood. There is even a sample page of interactive fiction sure to be of help to younger players. Also included in the package is a nautical chart, top secret Infocards with information about the crew and the equipment, and a special Infodecoder film used for revealing hidden clues found on the back of the Infocards. All of this is packaged in an attractive and functional portfolio for safekeeping.

The development of problem solving skills and the emphasis on logical thinking, along with the unique interaction using conversational English, create a superb educational environment to explore. Designed for the beginner of age nine years and up, hints are provided when necessary, making this adventure less frustrating than many others. (Like Frosted Flakes, it is not just for kids!) I'm sure that there are nine-year-olds who could handle this adventure with little difficulty, but most children of that age will need a good deal of assistance, especially early in the game.

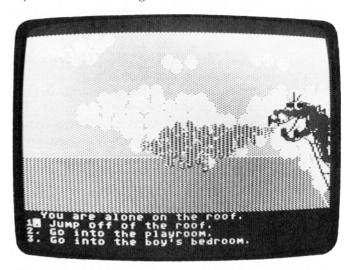
**Seastalker** is a class act. It's fun, exciting and educational. (Did I mention fun?) All young adventurers are certain to enjoy this dive deep into danger.

DRAGON'S KEEP TROLL'S TALE SIERRA ON-LINE, INC. Coarsegold, CA 93617 48K Disk \$29.95

I do not know if Sierra On-Line was the first to introduce the illustrated adventure for the Atari, but **Wizard and the Princess** was the first one that I had seen and, subsequently, purchased. That initial endeavor remains one of the finest adventures ever produced.

Now the same company has introduced a junior adventure for children ages eight years and older, using their successful illustrated text format. For those of you unfamiliar with this type of adventure, it follows the same basic format of a text adventure with graphic enhancements.

Two-word commands are used to communicate with the computer (e.g., *OPEN DOOR*). Many objects, characters, etc. specifically named in text adventures must be discerned from their appearance in the illustrated version. A table may be the only readily visible fixture in a room, the secret note beneath it not graphically depicted until the command to look under the table is given. Although sometimes limited in the degree of complexity compared to text-only adventures, the illustrated adventure offers a distinctly different challenge with its visual clues.



Dragon's Keep.

In **Dragon's Keep** and **Troll's Tale**, Sierra On-Line has maintained the same approach to adventuring, with one significant difference. Instead of having to decide the precise command to enter—probably the single most difficult aspect of an adventure game—the player is given an option of what to do. On entering a room, one decides whether to LOOK IN THE BOX, GO TO THE WINDOW or GO BACK OUT THE DOOR. These commands are entered by moving the cursor with the space bar until it's over the desired command and hitting the RETURN key. A child must be able to read at second or third grade level, but does not have to type in the commands.

The two game themes are appropriately geared for young children. In **Dragon's Keep**, a magical dragon holds sixteen animals captive in a variety of places. The child must find and then release all of them. In **Troll's Tale**, the object is to discover sixteen hidden treasures and return them to the Dwarf King. In both adventures, if the "bad guy" appears in a particular location, the player must return there later to accomplish the specific task.

Although challenging to the youngster, the frustration of playing "What am I thinking?" with the computer is eliminated. Persistence and trying all of the options will eventually lead to success (just like real life). One doesn't have to be concerned with entering a room with a single, locked exit without the key—and being stranded forever. Best of all, the ever present fear of extinction, so much a part of the usual adventure, does not exist.

There are a number of commands which, when selected, result in silly responses. These diversions are of little consequence in the adventure itself, but are right on target when it comes to hitting a child's funny bone.



#### Troll's Tale.

In addition to the usual educational benefits of adventures, these two programs stimulate the use of reading skills in concert with object recognition. This perceptual coordination is of great importance in the further development of reading comprehension. To assist in the strengthening of skills necessary to map out an area, a map is included with each game. There are also stickers of found objects, which can be placed on the map in the appropriate locale.

The instructions for playing are on the disk and are very easy to understand, requiring little, if any, adult supervision. The graphic illustrations and command options are very well coordinated—not in the least confusing. In spite of the titles, these adventures are devoid of any evidence of violence.

The next step to higher levels of adventure gaming—and the development of the more complex skills required to play them—have been made much easier with the introduction of these two games. **Dragon's Keep** and **Troll's Tale** will provide hours of stimulating fun and excitement for children with an adventuresome spirit.

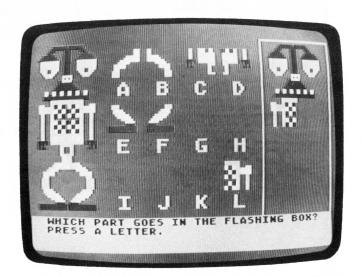
TONK IN THE LAND OF BUDDY-BOTS Sprout Software MINDSCAPE, INC. 3444 Dundee Road Northbrook, IL 60062 48K Disk \$34.95 (314) 480-7667

Emergency! Emergency! There is trouble in Buddy-Bot Land! A Buddy-Bot's parts are scattered everywhere. The Buddy-Bot needs Tonk to collect his parts and put him together again.

So begins an adventure of Herculean proportion, at least for the four- to eight-year-olds for whom this game is intended. When the staff at ANALOG Computing gave me this game for possible review, I was fascinated by its title. That, as much as anything, was the reason I loaded it up immediately, instead of sticking it in the "programs to review tomorrow" stack, as usual. I'm glad I did, because here is a game with an adventure theme for very young children...which fits in perfectly with the other reviews this month.

Having arrived in Buddy-Bot Land, **Tonk** searches for the lost parts of a robot-like character called a Buddy-Bot. Depending on the level of difficulty (1-4), one of 128 varieties of these creations is divided into as few as three and as many as twelve parts, which are scattered throughout the land. Using a joystick, the player collects these parts by touching them, continuing on until the sum of all parts equals the whole (I've *always* wanted to say that).

It's not as easy as it may sound. A number of pit-falls await the brave **Tonk** as the quest progresses. Mean old Gork is a mischievous dude who lives in a castle at the edge of the CrissCross Sea. His soldiers are out on patrol, and if **Tonk** is captured, he is sent to Gork's castle—and must search for a lost part there before escaping. Gork's soldiers move pretty fast and are not easy to outmaneuver. Black holes, which suddenly appear throughout the land, and sky holes, found in the castle, are additional perils to be avoided.



Tonk in the Land of the Buddy-Bots.

Travel is mostly by foot; however, a cable car and a raft provide welcome transportation through some parts of Buddy-Bot Land. As a boon to our bold traveler, there are special caves to be found in the kingdom. One may enter these caves and play one of five different games with a missing Buddy-Bot part as the reward for winning.

The games are fun in themselves and stimulate the

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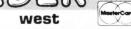


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(continued from page 11)

development of skills in the areas of memory, concentration and visual discrimination. The Different/Alike game displays six Minibots (a smaller version of the Buddy-Bot?) and requires the child to select the pair that is either the same as or different from the others. Further practice with recognition of shapes and patterns is provided in Match the Shadow, where a Minibot shown on one side of the screen must be matched by choosing from a group of four to ten shadows of Minibots. Minibot Shuffle, not to be confused with "The Curly Shuffle," is a variation of the old shell game, which makes it necessary to concentrate on the particular box hiding the Minibot. In Remember Me, a Buddy-Bot is displayed and then vanishes from the screen. The task is to select individual body parts from a group of four and reassemble an exact replica of the original. This is a real toughie and will certainly enhance memory skills.



Tonk in the Land of the Buddy-Bots

The last game is Buddy-Bot Puzzle. Here, a Buddy-Bot is shown on the left; its component parts (twelve in all) are randomly scattered in the middle of the screen. In an area on the right side of the screen, a red box flashes in a variety of positions—where specific body parts belong. The appropriate part is selected as the puzzle is pieced together. Thoughtfully, an option exists allowing one to just play the games without having to participate in the adventure.

Tonk in the Land of the Buddy-Bots is an exceptional example of educational software. The colorful graphics, clever animation and original music further enhance this quality product. The experience of learning one's way about in a strange land—and the excitement of danger without the possibility of any real harm befalling our hero—makes a nice combination. This multifaceted adventure game for very young children looks like a winner. □



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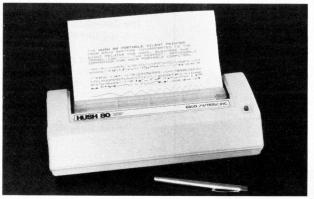
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ble, paper and wall transformer.

\$159.00. Ergo Systems, 1360 Willow Road,

Menlo Park, CA 94025 - (415) 322-3746.

#### WANTED: GUMBALL FACTORY MANAGER

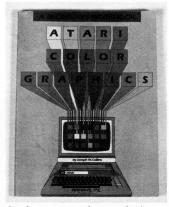
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quota (keeping an eye on the time clock). Should Mr. Nitpicker catch an error in your work, he'll charge in and tip your bin over. And, just when things were finally beginning to get worse, the word goes out that spazzed-out dental assistants are trying to sabotage the factory by blowing it up!

48K disk, \$29.95, Broderbund Software, 17 Paul Dr., San Rafael, CA 94903 — (415) 479-1170.

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#### GETTING STARTED — A HEAD START

Getting Started with the Atari 600XL is a worthlooking-into new book that covers the BASIC basics, from the ground up.

Some of the chapters help the reader understand and utilize sound effects, simple graphics and plotting, and some of the Atari peripherals. Getting Started...also contains one of the best explanations of the ERROR codes I've seen to date.

BASIC commands, with



their proper syntax, are explained here in a way that makes understanding easy. Short, sample programs will help you learn how to use certain commands, such as: strings, graphic routines, the joystick/paddles and sound.

Getting Started is 140 pages long, softbound.

Written by Peter Goode, the book retails for \$12.95. It's distributed by David & Charles, Inc., North Pomfret, VT 05053.

#### **HIGH-END MODEM FROM ANCHOR**



Anchor Automation offers a new modem in its **Signalman** line, the **Mark XII**. Emulating the command structure of the well-respected Hayes **Smartmodem**—with even

more enhancements, Signalman can be operated manually through a keyboard (without computer coding) or automatically, with the ability to answer or originate calls at 1200 baud (special lines) or 300 baud (standard lines).

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ble and two telephone jacks.

The cost of the **Mark XII** is \$399.00; from Anchor Automation, 6913 Valjean Ave., Van Nuys, CA 91406 — (213) 997-6493.

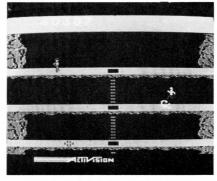
#### **ACTIVISION ANNOUNCES TWO NEW GAMES**

Pitfall II: Lost Caverns takes us on the further adventures of Pitfall Harry. Similar in concept to its best-selling predecessor, Pitfall II finds Harry leaving the jungle for the far away mountains of Peru, with you controlling his arms and legs. As Harry with his niece, Rhonda, and pet mountain cat, Quickclaw—sets out to explore a vast underground complex full of killer frogs, eelinfested waters, bats, scorpions and much more, he's on the lookout for the lost Raj Diamond. Eventually, Harry must also find his niece and cat, as they all split up when they entered the Lost Caverns. Many surprises await, and Harry can now swim, fly (by grabbing a balloon) and climb. An elaborate musical score accompanies the game.



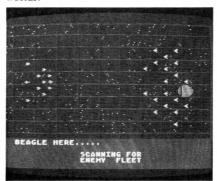
Activision has also released **H.E.R.O.** (Helicopter Emergency Rescue Operations), where a "man on a prop-pac" must find and bring back trapped miners from a huge cave network.

Pitfall II and H.E.R.O. list for \$34.95 from Activision, 2350 Bayshore Frontage Road, Mountain View, CA 94043 — (415) 960-0410.



#### QUEST OF THE SPACE BEAGLE

Avalon Hill's latest interactive adventure is a sequel to **Jupiter 1999** and is, like its predecessor, set in outer space. As the only survivor from a previous other-worldly episode, you are (unfortunately) the candidate for hero in this battle between two alien worlds.



The peaceful Faunians have chosen you as their savior to fight the evil Gentuzians, in a pre-emptive strike against the Gentu-

zian homeworld. After you win the battle for the "good guys" (assuming that you do win), they'll want you as emperor...and why not? But all you desire is to repair the **Space Beagle** and get out.

Other surprises are in store for you in the 48K game, which can be saved to continue play at a later date. \$35.00 from Avalon Hill Microcomputer Games, 4517 Hartford Rd., Baltimore, MD 21214 — (310) 254-9200.

#### **CARD?/AT FROM CARDCO**

CardPrint/AT is a new parallel interface which enables simple plug-in and print capability for the Atari computer owner. It's compatible with any standard parallel input printer, whether it be dot matrix, thermal, daisy wheel or letter quality...even multicolor pen printer/ plotters.

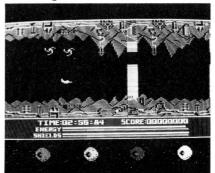


This unit negates the need for an Atari 850 interface module or special programming, and accepts all the standard Atari print commands. All cables and connectors are included, along with a lifetime warranty. \$79.95, CARDCO, Inc., 300 South Topeka, Wichita, KS 67202.

#### **IMAGIC'S 1-2-3**

This new disk from Imagic contains three new games for the Atari home computers.

Laser Gates (my favorite) is a Defendertype shoot-'em-up with horizontal scrolling and plenty of things to fire at. The goal is to reach the CPU and destroy it, then proceed to the next planet, and so on. You must negotiate the solid grey walls, missiles swirling asteroids, floating hamburgers and the laser gates.



In Wing War, you must hunt and destroy the Dragon's enemies and change them into crystals. Crystals, when brought back to the Dragon's lair, increase your firepower and overall crystal strength. Other crystals can be found at the geyser and volcano. When Gargok the Guardian is destroyed, firepower and defensive energy are gained.

Quick Step is a sort of Q\*bert "jump on the food" game, where you must also outsmart your opponent by using magic and bites.

Cost: \$24.95 for 32K disk. From Imagic, 981 University Ave., Los Gatos, CA 95030 — (408) 399-2200.

# A Report on AtariCon '84

#### by Arthur Leyenberger

The first international Atari users convention, or AtariCon, was held in Southfield, Michigan on August 25 and 26, 1984. The convention was sponsored by the Michigan Atari Computer Enthusiasts (MACE) and the Capitol Hill Atari Owners Society (CHAOS). They should be given credit for their hard work in planning, organizing and staging the convention.

There has been a need in the Atari users community for a convention of this sort for some time. Other major computer groups have met like this, so why not Atari users? With the recent buyout and reorganization of Atari under Jack Tramiel, the need to make Atari users' voices heard is even more important. It was in this spirit that this year's AtariCon was held.

#### Starting over.

Originally, AtariCon was scheduled for October of 1983. It was being sponsored by MACE alone and was to have over fifty exhibit booths, dozens of seminars and a major Atari display. With visions of trying to duplicate CES (the Consumers Electronics Show), plans became too ambitious. This, together with a lack of support from the local group, doomed the 1983 convention.

The fact that AtariCon '83 was a bust hurt the organizers of this year's efforts. Many companies became disillusioned with MACE and the idea of an Atarionly convention after the first time. It was also felt that last year's attempt at a show was viewed as a MACE event, rather than a national Atari convention. Therefore, the two local user groups, CHAOS and MACE, teamed up to organize and run the August convention.

This year, it was decided that there would be a show, regardless of how small it turned out to be. As long as there were a few vendors willing to participate, the organizers were determined to get the first Atari convention off the ground.

Ike Hudson from CHAOS and Mike Lechkun from MACE were the two coordinators of this AtariCon. MACE provided about 75% of the \$5000 budget, and the two groups split the work evenly. About thirty people volunteered their efforts to help with the convention. The Jersey Atari Computer Group and the Penninsula Atari group of Virginia were contributors, and the Wiesbaden (West Germany) Atari group sent all they could afford—mostly moral support.

#### In a nutshell.

There were approximately twenty booths displaying their wares at AtariCon. The most notable, OSS (Optimized Systems Software), was not only hosting a booth, but also gave most of the seminars on programming and other topics. Friendly Bill Wilkinson was there, as was Clinton Parker of Action! fame. OSS was showing several new products. New "toolkits" for BASIC XL, Action! and MAC/65 were being demonstrated—and selling fast. These products contain utilities, subroutines and macros for getting the most out of a particular programming language. They retail for about \$40 and are available now.

OSS was also demonstrating a new word processor called **The Writer's Tool**. It comes on the now-famous OSS (bank-selectable) super-cartridge and supports single or double density disk drives. It looks like a powerful, yet easy-to-use word processor. It will be-

come available by the time you read this and will sell for about \$130.



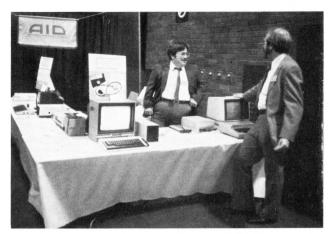
The amiable Bill Wilkinson of OSS.

Another vendor present was Advanced Interface Devices (AID), whose rep drove all the way from Florida to make the show. AID's president, Herman Price, said that there was a lot of interest in his products. AID makes the **R-Verter**, a \$49.95 serial bus modem adapter. It allows most modems and RS-232 devices to work with the Atari, without requiring an 850 interface. Their other product is called the **Interfast-1**, a buffered (4K memory) printer interface for Atari computers. It also allows various character sets to be created, stored and used on dot matrix printers. Currently available, it sells for \$129.95.



Show coordinators deep in discussions. In the foreground: Mike Lechkun of MACE (left), from CHAOS, Rob Peck (center) and Ike Hudson (right).

Alpha Systems was also there, selling their utility software. They have a sector copier/analyzer, a cartridge backup program, a keyboard customizer that allows macros to be defined and used with BASIC, and a graphics screen dump. George Morrison from Alpha told me that they were doing a brisk business. He must have been right, since there were always people crowding around his booth.



Herman Price, president of Advanced Interface Devices, talks with a potential customer after a long day.

The other booths were occupied by either local retailers or other Atari user groups. MACE, JACG, MilAtari, Penninsula ACE, London Ontario group and CHAOS all had booths at the convention. These were good places to introduce yourself and make new friends. Many of the user groups had t-shirts for sale. An interesting one being sold by MACE was a white shirt with a Commodore logo on it. Overlaid on the Commodore logo was the international road sign symbol for "not," a red circle with a slash through it. Very clever.



Thirteen user groups discuss their future and AUGI (Atari User Groups International).

Even though the vendor turnout was light, all these companies should be given credit for attending and supporting the user convention. All of the vendors reported that they made money at AtariCon, even though Atari did not show up. The rest were glad that they came and promised to show up next year at AtariCon '85.

#### Learning opportunities.

Quite a few seminars were held during the convention. Eric Hanson of the MilAtari group gave a very interesting lecture on 3-D graphics. Starting with simple examples, and showing more complex techniques as he went along, Hanson had the audience of about fifty listening attentively. Mark Rose of OSS gave a

talk on the ins and outs of being a programmer. He used examples of programming in BASIC, Logo, Pilot and machine language to show that, while programming can be fun, it's also a lot of work. Other and seminars included an overview of the three BASIC languages, an open forum for a potpourri of questions, a good lecture on OSS's Action!, and a discussion on game programming in machine language.

#### Who was there.

Attendance at AtariCon numbered about 1800. People of all ages—many families—came out for the day. The majority of Atari users who attended were from the local Michigan area. However, users came from as far away as Oklahoma, New Jersey, Canada and Panama. Interestingly, no West Coast user groups or members attended the show. Unfortunately, as a result of the smaller than expected crowd attending the show, MACE and CHAOS will lose approximately \$2500 on the event.

The most positive result from AtariCon '84 was that thirteen user groups met and decided to form a coalition. Called Atari User Groups International (AUGI), this group will allow Atari users to have a single voice when communicating with Atari—or anybody else. AUGI's goals are: (1) to provide a common voice for Atari users with Atari and other vendors; (2) to provide a common point of communications with Atari, other vendors and the user community; (3) to facilitate communications among user groups; and (4) to provide assistance to new user groups. User groups will be getting information on this soon from CHAOS or MACE.

#### Can we talk?

As it turned out, a side story at AtariCon was whether Atari would show up or not. Through a series of discussions with various people at Atari, the show's organizers had a verbal commitment that Atari would be there, complete with their CES booth, and "in a big way." At one point, it was believed that one of the Tramiels would also attend.

Had Atari been present at the convention, chances are that the two sponsoring user groups would have at least broken even. The events that led up to Atari's cancelling at the last minute are interesting—and a classic example of miscommunication.

Ike Hudson, president of CHAOS and one of the principal coordinators of the convention, began talking to Earl Rice and Mark Cator of Atari user group support in January of 1984. By July, these two men, long known to user groups, were no longer working for Atari. Throughout July, several discussions were held with West Shell, Atari's Director of Marketing. On July 31, West Shell finally confirmed to CHAOS that Atari would "attend in a big way."

In mid-August, calls were placed to Atari to confirm their attendance and to make any last minute arrangements. Atari management was unavailable, and

the calls were not returned. It was also learned that West Shell was no longer with Atari. Finally, on August 24, the day before the convention, Mike Aldrich, another of the convention's organizers, was able to get through to Brian Kerr, head of special events for Atari. Brian said he knew nothing about AtariCon, and that Atari could not afford to come, anyway.

When I arrived at the convention late Friday afternoon and learned that Atari was a no-show, I immediately tried to call Leonard Tramiel. Instead, I spoke to James Copland, VP of Marketing and an ex-Commodore man.

After a half-hour on the phone, I convinced Mr. Copland that his presence would help amend the bad press that Atari would receive for not showing up. He agreed that Atari users were important to Atari and he didn't want to alienate them. He promised to arrive on Saturday afternoon and, although he could not talk about products, he would be glad to make a statement. I went to sleep that night thinking that Copland was a sincere fellow and glad that at least someone from Atari would be at AtariCon.

The following morning, I learned that Mr. Copland would not be attending. A letter of apology with an offer of \$500 to help defray costs was sent instead. Mr. Copland stated that he was unable to arrange flight connections that would allow him to return to Sunnyvale for a Sunday morning meeting.

The new Atari had an excellent opportunity to "hit the ground running" by attending AtariCon. Since the sale of Atari to Jack Tramiel on July 2, no information had come out of Sunnyvale. Atari could have used the convention as a means of providing information on their plans for the future—and to show that they truly support Atari users.

I believe that Atari's absence was due not to malice but, rather, to things just slipping through the cracks. July and August were difficult times for the new Atari. Having just been sold, they were trying desperately to plug the dollar leaks. Jack Tramiel is running a start-up company now, and all of Atari's efforts are directed to putting the company in a position to make money for the first time in two years.

#### Epilogue.

In a follow-up conversation, James Copland told me that the new Atari will not let this kind of thing happen again. It was a case of complete miscommunication. Atari did not want to offend the user groups —or any Atari user. From talking to Copland, I got the impression that Atari would be present at the next AtariCon.

In spite of Atari's non-attendance, AtariCon '84 was a positive experience. It showed how dedicated Atari users are and what they can do. Personally, I was able to meet many of the fine user group volunteers who help make Atari computing as rewarding as it is. I look forward to AtariCon '85 as being an even better event. We'll see you there.

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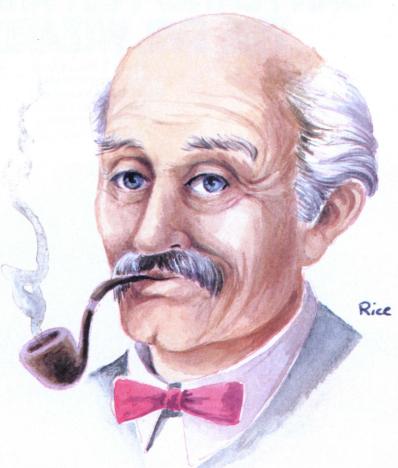
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#### by Donald Forbes

If you wish to demonstrate FORTH, there is no better way than to follow the steps of the masters. Even pygmies see farther than giants, if they stand on their shoulders.

The first question of any newcomer to FORTH is: what does it look like? We can do no better than to take the example of best-selling author Leo Brodie and of fig-founder Kim Harris in the early pages of *Starting Forth*. They show how a small letter F on the keyboard can become a large letter F on the screen. Here is their code, just as they present it.

```
SCR # 1
0 ( brodie large letter F )
1 : STAR 42 EMIT ;
2 : STARS 0 DO STAR LOOP ;
3 : MARGIN CR 15 SPACES ;
4 : BLIP MARGIN STAR ;
5 : BAR MARGIN 5 STARS ;
6 : F BAR BLIP BAR BLIP BLIP CR ;
```

In your demo, you must point out that, in FORTH, you create a new definition with a colon followed by a name (in this case, *STAR*) and then spell out what the definition does. Here it takes 42, which happens to be the ASCII number for an asterisk (45 would be a \$), followed by *EMIT*, which puts the asterisk on-screen. The next definition, *STARS*, puts *STAR* inside a DO...LOOP to draw multiple stars. *MAR*-

GIN is used to do a carriage return followed by a line feed and fifteen spaces. BAR and BLIP also draw on the previous definitions. In the final line, F puts them all together, so that an F on the keyboard puts a large F on the screen.

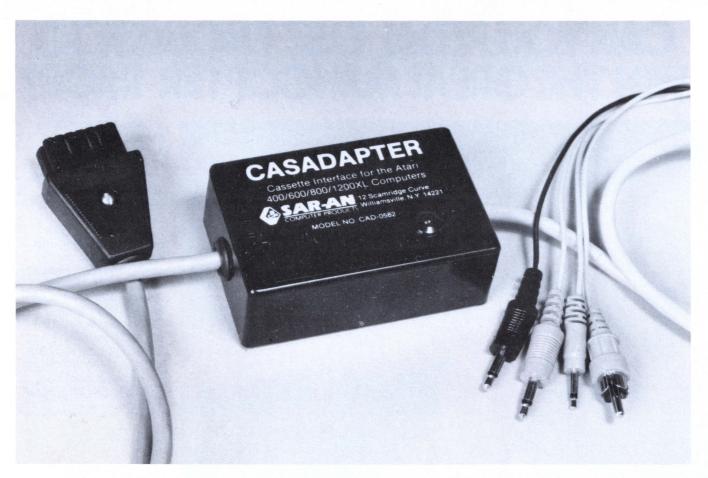
You can do this demo from the keyboard, but it makes more sense to put your code on disk as well. Then you can do your first demo from the keyboard but repeat it at will by loading it from the disk.

The six-line demo is an excellent illustration of the compactness of FORTH, but is apt to be confusing to a newcomer. A much smarter idea is to put the demo on one or two screens, with only one word or instruction per line—and *copious* comments after each word. This method uses much more space but makes everything many times more clear. Your audience will now be able to check that they understand the purpose of each word in the final program.

One of the pleasures of FORTH is that it is nice and compact, so that you write tight code with little typing effort. You should resist the temptation to do this at the outset. If anyone else is going to be reading your code, think about putting only one word (or a few) per line and then filling up the line with lots of comments. This takes more typing, but your audience will thank you. Furthermore, when you go back

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12 Scamridge Curve Williamsville, New York 14221 (716) 632-3441 to review your old code, you won't have to rack your brains to remember what you did. Most importantly, when you start to present the advanced features of FORTH to beginners, you will need to make sure that they follow you every step of the way, or you'll lose them in a hurry.

Here is the one-word-per-line version of Brodie's program.

```
SCR # 2
0 ( brodie
                      large letter F )
                     place a star on screen
save an ASCII asterisk
        STAR
       STARS
                     put asterisk on screen
                     display multiple stars
starting index of loop
begin looping N times
display an asterisk
branch back to DO
        ĎΟ
        STAR
        LOOP
       MARGIN
                     make 15 space margin
                            return, line feed
number 15
                     save number
11
12
13
14
15
16
17
18
19
        SPACES ;
                     display these spaces
                     single asterisk
        MARGIN
                     15-space margin
        STAR ;
                     asterisk
                     display 5 asterisks
                     15-space margin
save number of stars
        MARGIN
        STARS :
                     display asterisks
21
22
23
24
25
26
27
28
29
                     show large F
       BAR
                     five stars
        BLIP
                     one star
       BAR
                     five stars
                     one star
                     one star
                     carriage
line feed
                                  return and
       Type F to show large F )
```

If you walk your users through the program line by line, they should have a good basic understanding of what a FORTH program looks like.

This program only puts one letter on the screen. How about putting five letters on the screen? That will certainly make a more impressive demo. We can put the word *FORTH* on the screen by merely repeating and adapting the code which we used for the letter *F*.

I made some changes to get the code to fit one or two screens. Everything is standard fig-FORTH. Note that it will run just as well on either QS Forth by James Albanese from Quality Software, valFORTH from Valpar International or Team Atari Forth by Steve Calfee and others. No matter which FORTH you are using, I urge you to get a copy of Calfee's public domain FORTH—which may be available on a bulletin board from the Bay Area Atari User Group in San Jose, CA. There is nothing to compare with it for instructional purposes—it follows religiously the fig-FORTH model and has a valuable decompiler and disassembler which I have not seen elsewhere. Sending a \$15 check to the Jersey Atari Computer Group, attention of Don Ursem, 37 Clover Lane, Randolph, NJ 07869 will get you both disks number 19 and 20.

```
5CR # 3
0 ( forth demo
                                                                             7/08 )
         DECIMAL 125 EMIT : FF
: FSTARS 0 DO FF LOOP
: FMAR CR 1 SPACES ;
                                                                               70 EMIT ;
               FMAR CR 1 SPA
FBLIP FMAR FF
                                               SPACES.
               FBLIP FMAR FF;
FBAR FMAR 5 FSTARS;
F FBAR FBLIP FBAR FBLIP;
00 79 EMIT; : SP_SPACES
               00 79 EMIT; : SP SI
OSTARS 0 DO 00 LOOP
               OSTARS 0 DO OO LOOP;
OMAR CR 8 SP;
OBAR OMAR OO SP OO;
OBLIP OMAR OO SPACE 3 OSTARS;
O OBLIP OBAR OBAR OBLIP;
RR 82 EMIT;
RSTARS 0 DO RR LOOP;
RMAR CR 15 SP;
RBAR RMAR 4 RSTARS;
RBLIP RMAR RR 3 SP RR;
R RBAR RBLIP RBAR RBLIP;
               TT 84 EMIT ;
TSTARS 0 DO TT LOO
TMAR CR 21 SP ;
TBAR TMAR 5 TSTARS
TBLIP TMAR 2 SP TT
                    TBAR TBLIP TBLIP TBLIP ;
              HH 72 EMIT;
HSTARS 0 DO HH LOOP;
HMAR CR 28 SP;
HBLIP HMAR HH 3 SP HH;
HBAR HMAR 5 HSTARS;
H HBLIP HBLIP HBAR HBLI
FOR 125 EMIT F O R T H
               HH 72 EMIT
26
28
30
                                                                           T H QUIT ;
```

The first line has DECIMAL followed by 125 EMIT. The word DECIMAL was included to make sure that we did not default to HEX, as Calfee's disk will do. The statement 125 EMIT clears the screen, since 125 is the ATASCII clear screen character. SP is just my abbreviation here for SPACES. Instead of STAR, I used FF for F (which is 70 EMIT), 00 for 0 (which is 79 EMIT), and so on. MARGIN, for example, was abbreviated to FMAR and TMAR to squeeze each instruction into one line. As the last line shows, typing FOR will put up the word FORTH, so as to fill the whole screen. This makes for a much nicer demo.

#### Explaining FORTH.

Now is a good time to bring up the question: what is FORTH? Whether you want to pose this question to your audience is up to you. If they are just looking for entertainment, you may want to postpone it. But, if they have any background in computer hardware, assembly language or mathematics, they may find it fascinating. And, once anyone is hooked on FORTH, there is no turning back.

We can always explain, as most people want to do, that FORTH is a computer language and operating system, but this seems like trying to describe an automobile as a "horseless carriage" to an Eskimo who has never seen a horse. He will keep wondering about the strange animal called a horse and never give a thought to the carriage. When you ask him to repeat the explanation, he won't know where to begin.

What does FORTH do? A good question. Before answering, how about another question: what does an automobile do?

"The way to describe an automobile is first by thinking about what it is for, about its function, and note

the list of items that make up its structure," according to Harry Katzan in his book on systems design and documentation. "If you think about its function (what it is for), you won't describe it by talking about its four wheels, its engine, size, and so on. You will think about it as a means of transporting a few people from one place to another at a certain cost."

We can take the same approach. In any computer system you have a user who is looking for answers, a piece of hardware (in our case, a keyboard, screen, CPU, memory, disk and printer) and a set of software which, in the final analysis, invokes some mathematical operation or algorithm. The mathematical operation may be arithmetic  $(+, -, *, /, \wedge)$  or logical (AND, OR, NOT) or comparison (=, <, >). The mathematical operation hands its answer back to the software, which passes it back on to the hardware, which hands it to the user via the screen, the printer or perhaps even the disk.

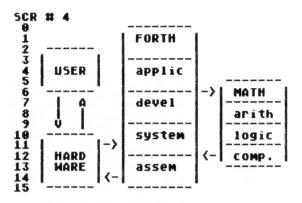
Where does FORTH fit in this pattern? The central and inescapable fact is that FORTH is the complete software interface. This one reality sets FORTH apart from all other software. There is no software in your Atari until you've loaded the FORTH disk—FORTH is the genie that brings your hardware to life and prepares it to do your bidding.

#### FORTH history.

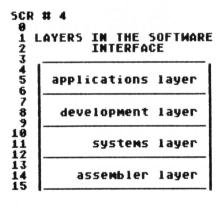
This is really how FORTH got its start. Bill Ragsdale (an electronics engineer from California, who also belongs to the Society of American Magicians) founded the Forth Interest Group and served as its president for five years, until last April. He remarks: "FORTH then (1978) was really an operating system for what I call a crippled computer. FORTH has been treated in a receptive way by users of computers with very limited resources in terms of memory, mass storage or input/output. The Varian 620i was a crippled computer. Some of the early Hewlett-Packards, the 2100 series for instance, had very limited manufacturer support. In such cases, FORTH has been graded with very high marks." To which he adds the following comment: "On the other hand, we in the FORTH community face a very real problem, in that, as the manufacturers have provided increased quality in software, the need and demand for FORTH appears to diminish. FORTH was providing some irreplaceable attributes five years ago. Now it appears that a number of those attributes are no longer as attractive as they were. For example, there is more memory space available, I/O is faster, more disk space is available, file structures are less limiting. This puts an increased challenge on people using and writing FORTH systems. Are they going to stay back in the "crippled computer" mentality, or are they going to continue to grow and follow industry needs?"

Despite the industry changes, FORTH holds a unique position as a complete self-contained software interface to the computer hardware.

Here is one diagram you can create for yourself. It shows how the user invokes the hardware to invoke the software to invoke a function that returns an answer via the software and the hardware, back to the user.



Here is another diagram for you. It may look like a chocolate layer cake, but really spells out the different layers that must be present in any working software interface to any computer hardware system. In fact, the diagram really shows why FORTH is FORTH—why FORTH is unique and can do all those marvelous things that no other software interface can.



The applications layer represents the applications programs and systems with which most users of personal (and other) computers are familiar. Word processing, database management, spread sheets, graphics packages, accounting systems and spelling verifiers are a few examples.

On the development layer, we have the tools that a programmer uses to develop his applications, including a slew of languages, from FORTRAN, COBOL, PL/1 and PASCAL to SNOBOL, APL and LISP (Lots of Irritating, Superfluous Parentheses!) to one of the latest and the one with the shortest name, C (which, in turn followed from the B language written by computer chess expert Ken Thompson in 1970). On the development layer, we also have such programs as editor and debugging packages.

At the systems layer, the software has to do cold and warm starts, as well as talk to the files and the peripherals (which go under such names as OS, DOS, MS-DOS, PC-DOS, UNIX, VENIX and XENIX.

Underneath all these layers lies the assembly (or machine language) layer, which consists simply of *Os* and *Is*, and is the only language that the computer hardware can understand.

The ultimate justification for FORTH is that it *spans* all these layers, can do what all these layers are supposed to do and, in addition, can do—at the level of a high-level language—what no other software can. If FORTH were just another high-level computer language or just another operating system, there would be little reason to take the time to learn it; the advantages of compactness, speed and virtual storage have been neutralized to some extent by advances in computer hardware over the past seven years. Smaller and faster chips, however, have had no impact on our unique ability to remain in FORTH and float up, down and back from the applications to the development, to the systems and assembly layers as we choose—and within a single definition.

Our simple little program to put a letter *F* on the screen serves not only as an excellent demonstration of structured coding without GOTOs, but also of the multiple layers of FORTH.

The applications layer, of course, is our demonstration of the word FORTH on the screen.

The development layer is clearly visible on the disk screen where we created the original program by the use of the editor and the associated debugging features.

The systems layer can best be appreciated by executing the DECOMP instruction in either valFORTH or Team Atari FORTH (which makes this FORTH a worthwhile investment). If we do DECIMAL DECOMP STAR, we get approximately the following:

5AE6 : LIT 42 5AEA : EMIT 5AEC : :5

If we do DECOMP STARS, we get a clear illustration of how the systems layer of FORTH takes our coding from the development layer and converts it into executable code. This is what we get:

5AF8 : 0 5AFA : (DO) 5AFC : STAR 5AFE : (LOOP) TO 23292

Here FORTH's systems layer inserts the forward and backward branches that are needed for the specified iterations of the DO loop. You can DECOMP the rest of the words for a better appreciation of the FORTH systems layer.

How about the assembly layer? For that, we need some extra apparatus. We need a way to see what the assembler code looks like. We can do this easily with nothing more than the instruction DECIMAL 0 200

TYPE, which will type out (beginning at address 0) the next 200 bytes of memory. This output is hard to read. We can improve readability by creating a few simple dump routines to display memory in graphics characters, or by bytes in decimal or hexidecimal. In these examples, AAA is the starting address and BBB the ending address.

```
: DUMPG BBB AAA
DO I 1 TYPE SPACE LOOP;
: DUMPD BBB AAA
DO I CE . SPACE LOOP;
: DUMPX BBB AAA
DO HEX I CE . DECIMAL LOOP;
```

Let us now dump the assembly code for our letter *F* program. The address of the code will be different, depending on what FORTH we are using, and how many words are in our dictionary. The general pattern, however, remains the same. To find the starting address, we only need 'STAR' (pronounced "tick STAR" dot). From this information we can arrive at the starting and ending addresses for the dump.

In the dump, we see the names of the words in our program: STAR, STARS, MARGIN, BAR, BLIP and F. Each word begins with a so-called head, which con-

(continued on next page)



tains an indicator of its length in bytes, followed by the name of the word, then a pointer to the previous word (to allow dictionary searches), followed by a code field address (points to the code to be executed) and, finally, a "body" with one or more parameter field addresses (these point to previously defined words which we included in the definition of our original word).

The byte structure of each word is a topic that is longer than you can afford to include in your demo at this stage. There is one important point, however, which must not be overlooked. Dr. C.H. Ting of the Lockheed Missiles and Space Company wrote a book called Systems Guide to fig-FORTH (\$25.00, Mountain View Press, P.O. Box 4656, Mountain View, CA 94040), which is the only one I have seen designed specifically to "deal with the inner mechanisms on how the FORTH system operates, which is essential to the understanding and effective utilization of the FORTH language." He notes that "the FORTH language is a major synthesis of many of the concepts and techniques used for some time in the computer industry, such as stacks, dictionary, virtual memory and interpreter. The single most important invention by Charles Moore in developing this language, which wrapped all these elements and rolled them into a small but powerful operating system, is the code field in the header of a definition. The code field contains the address of a routine to be first executed when the definition is called."

In the May issue of Forth Dimensions, he appends, "Code fields and the associated inner interpreters are the sole inventions Mr. Charles Moore brought us in FORTH. Stacks, the dictionary, indirect threaded code and virtual memory were all well-developed techniques before FORTH was invented. Using the code field to identify a specific interpreter to execute a particular command was not obvious or considered useful prior to that time. The code field sets FORTH apart from any other type of language or programming constructs, and it is the most unique feature in FORTH or FORTH-like systems. Many of the attributes associated with the FORTH language, such as compactness, simplicity and extensibility, can only be realized with the use of the code field."

The idea to keep in mind is that the CFA or code field address plays a central role in the operation of FORTH. To know how FORTH works, we must have a clear picture of the function CFA performs when it interacts with other FORTH components. A proper understanding should, as Dr. Ting says, "be able to cut through much of the mythical fog often surrounding FORTH."

No demo of FORTH, however, should get bogged down in a discussion of points of theory, no matter how important. So let us add some final fireworks to keep our audience psyched up.

This program will put a colorful pattern on the screen:

: MOIRE 24 GR. 1 0 14 SETCOLOR 2 0 0 SETCOLOR 318 0 DO 1 COLOR 159 0 PLOT I 191 DRAMTO 3 +LOOP 30000 0 DO LOOP;

If you have **QS Forth** (and Ekkehard Floegel's book Forth for the Atari), note that the inputs to the SET-COLOR statement are reversed, while PLOT and DRAWTO have the COLOR statement embedded. Instead, do this:

: MOIRE 24 GR. 14 0 1 SETCOLOR 0 0 2 SETCOLOR 318 0 DO 159 0 1 PLOT I 191 1 DRAMTO 3 +LOOP 30000 0 DO LOOP ;

This program provides a flashy display:

Be sure to tell your audience to watch for the next exciting installment in the continuing sage of the wonderful world of FORTH!  $\Box$ 

Send letters to:

Ask Mr. Forth
P.O. Box 23
Worcester, MA 01603





by Steve Panak

Spring has again grown into summer, which in turn decayed into fall, prompting us to focus our attention on end-of-the-year events: lousy weather, school (for those of us *lucky* enough to still be attending) and, of course, the big one—Christmas. Here we'll take a look at a number of entertainment programs which may find themselves on Christmas lists throughout softwareland. So read carefully, then go out and take a look for yourself. Make that list, check it twice, and you'll end up with a pleasant holiday season rather than a miserable, monotonous one.

PENGO ATARI, INC. Sunnyvale, CA 94086 16K Cartridge \$44.95

**Pengo** takes the player to an Antarctic wasteland, where he must do battle with the nasty Sno-bees in this **Pac-Man** derivative.

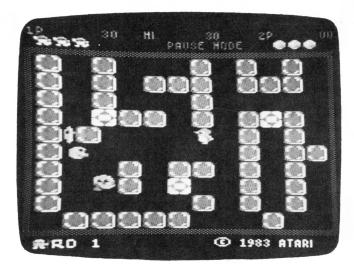
**Pengo** is a penguin fighting a never-ending battle to survive. As if it isn't hard enough to find food and keep warm, he is terrorized by creatures whose touch means certain death. But all is not hopeless; he has numerous methods by which to defeat these menaces.

He can crush them with ice blocks which he kicks across the screen, or he can freeze and destroy them in one of two ways—he can kick the wall and freeze a Sno-bee against it, or he can line up the three diamond blocks for extra points, again freezing his foes in their tracks.

Once frozen, the tables turn; now **Pengo**'s touch is deadly to his helpless adversaries. But new Sno-bees are continuously hatching. Only by remembering just which cubes have eggs can **Pengo** destroy the creatures in their shells. Once a level has been cleared of all the Sno-bees, play continues with faster and smarter antagonists. Finishing a round in record time awards extra points and, at 30,000 points, a new life is obtained.

Pengo is an arcade conversion, licensed from Sega, and the inevitable question is: how does it compare to its coin-op counterpart? The problem I have is that I live in an area that the city-folk refer to as the country, and the country folk refer to as the boondocks; we have just graduated from Space Invaders (remember that one?) to Pac-Man. Well, it's not quite that bad, but we are anywhere from a year to two behind the rest of civilization. So, the point is that I have

never seen the arcade version of **Pengo**. However, one of the best compliments one can pay to a home video game is that it *looks* like an arcade game, and **Pengo** does. With superb graphics and high quality sound, about the only thing missing here is the silk-screened cabinet.



#### Pengo.

Pengo, unfortunately, is not without fault. While the program can handle a number of simultaneously moving objects, too many will noticeably slow down the action. Still, the effect is not irritating and only makes play a bit easier. The main problem is not with the program, but with the game concept itself. Pengo is just the same thing done over and over and over again, with no change in its scenery, strategy or substance. Unlike some games with various changing screens (Ms. Pac-Man, Donkey Kong, etc.), the action in Pengo only gets a little more intense, like the original Pac-Man. Perhaps I'm different from everyone else, but I need a little more. Pac-Man was great in its time (how many years ago?), but many a Pac-Man machine now lies dormant in favor of those with more variety. Pengo provides no incentive to continue, except to get the high score. For me, that is simply not enough.

INFIDEL by Michael Berlyn INFOCOM, INC. 55 Wheeler Street Cambridge, MA 02138 32K Disk \$42.95

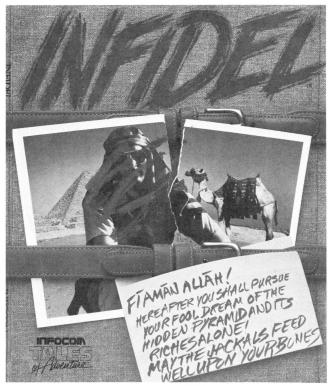
Infidel (n. a disbeliever in something specified or understood) is Infocom's first entry in its newest series, Tales of Adventure. While their previous voyages have taken us to distant galaxies or faraway magical lands, Infidel is set in Egypt, and so, in that respect, it's down to earth. But the quality of this game is nothing less than out of this world.

In **Infidel**, you take on the persona of one of the least likable main characters to appear in any of Infocom's games. You are an archeologist stranded in the desert—through your own fault—and now you must either shrivel up like a parched prune or discover one of the most magnificent treasure troves in the history of Egyptology.

The packaging is just what we have come to expect from Infocom. The manual is in the form of a pulp adventure magazine, and a personal diary provides you with a reasonably disgusting set of personality traits.

It seems that, after a rather disappointing tenure as an archeologist's assistant, you have become restless and decided to branch out on your own. So, of course, you lied and bilked an ancient map out of an old spinster who was trying to employ your boss. Then you dumped all of those moral people and set off to grab it all for yourself.

But your greed overshadowed what negligible good sense you might have had and, after insulting the local help's religious customs, you found yourself waking up from a drugged camel's milk drink. Alone. In the desert. With nothing for miles except a plane which dropped a single, parachuted item and then slowly shrank to a speck in the sky. Now you can insert the disk and get control of your life.



Infidel.

In the first phase of the game, you must survive to find the pyramid. This is really not a very difficult task, unless you forget an important item from your camp—or run out of food, water or time. Your greatest challenges await you in the great pyramid's chambers.

Each area contains an ancient puzzle, issued eons ago. Infidel's solutions do not rely on magical items or spells (but there may be a curse or two; no self-respecting pyramid would be without one). Each trap seems as if it may have been designed by the pyramid's builders to prevent looting, and they're all reminiscent of the *Raiders* films of late. Careful reasoning and observation will allow you to solve these problems. But there are also clues.

On the walls of the mighty pyramid are hieroglyphics. If these are deciphered, they offer valuable clues to aid you in your quest for riches. Interpreting these is a relatively good exercise in its own right. Though solving them is not essential to finish, they are an extra which provides the game with depth. Write down all the marks you can find, then translate them using traditional code-breaking methods (i.e., spotting common words). This is another challenge you accept when playing Infidel.

All of the basic Infocom program features are present; SAVE game, as always, is a must for the weary adventurer. In fact, this product is, overall, just what we have come to expect from the people at Infocom—high quality entertainment, imitated but never equalled. **Infidel** is a worthy addition to their software library, and to yours.

MR. ROBOT and his ROBOT FACTORY DATAMOST 9748 Cozycroft Avenue Chatsworth, CA 91311 (213) 366-7160 48K Disk \$34.95

Mr. Robot and his Robot Factory is a game which supports the old proverb warning us never to judge a book by its cover. A rather spartan container holds what, surprisingly, turns out to be a relatively decent game. It consists of two parts: Mr. Robot (the game) and the Robot Factory (a program which allows you to custom design your own playing screens).

Mr. Robot is a true hybrid game, with themes borrowed from many predecessors. You must clear dots (Pac-Man) from an irregular, ever-changing screen of ladders, poles and other pathways (Donkey Kong Junior), while jumping over or destroying alien fireballs (Donkey Kong). An energizer enables you to successfully defeat these fireballs. However, there are also original (I think) concepts here, as well.

Some screens contain bombs you must cross over. Stepping on them ignites their fuses, which burn for a short time before the devices explode. If you happen to be *on* one of them when this happens, **Mr. Robot** is reduced to Mr. Junk.



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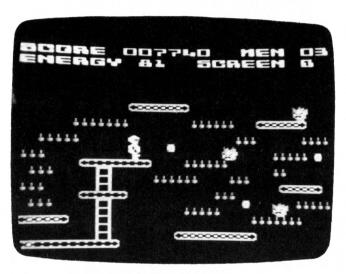
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The bombs are also very effective against fireballs. Trampolines allow you to survive longer falls; magnets, when touched, divert your vertical fall either to the left or the right. Transporters allow you to move around the screen—just like Mr. Spock. Extra lives are earned, not by exceeding a stated score, but by touching life tokens scattered on various levels.

Overall, the game is okay. The graphics are mixed. While most of the obstacles are fairly detailed (the fuses on the bombs burn nicely), **Mr. Robot** himself seems only slightly above the graphic capability of the old 2600. There are twenty-two screens to challenge you, and you can start at any level you wish. Music (by Paradise, whatever or whoever that is) supplies background sound at least as good as any Top 40 radio station. The real gimmick is the **Factory**.



Mr. Robot

By using the **Robot Factory**, you can design your own screens and store up to twenty-six of them, to play in your own order. Using a method much like that in **Pinball Construction Set**, you select components via the joystick and move them to any desired position on the screen. Then you can test, play, store and edit them, until you have your own ultimate game.

This feature is well done but does have a few faults. The disk controls are directly beneath the game components, so, if you happen not to be paying close attention, you are likely to move the cursor over one of these and erase your current creation. Also, they seem to have forgotten to place a "free life" token among the components. Thus, you're unable to incorporate this feature in any of your screens.

Documentation is shabby, drab and colorless, and will probably stop any potential buyers at the show-case. My recommendation is that you go further. Ask to load the game and play it a couple of times. Look at all the screens and feel the power it gives you.

While Mr. Robot may not be a welcome addition to a library full of other, similar arcade games, it may be the best buy for a first game...and it's a must for

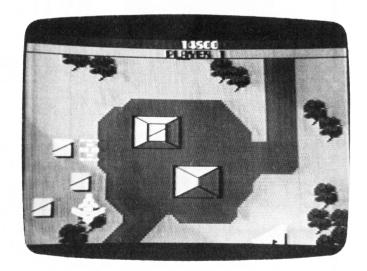
anyone who frequently mutters, "I could have designed that game better."

FLAK FUNSOFT (IJG, INC.) 1953 W. 11th Street Upland, CA 91786 32K Disk \$34.95

Flak disputes the theory (you can't judge a book by its cover) supported by Mr. Robot; it turns out to be a disappointing endeavor to copy a superb arcade game. Again we see a package that is somewhat less than physically attractive. Being of a curious and open-minded nature, we open it up to take a look.

Surprise! **Flak** is a cheap attempt to rip off the arcade game **Xevious**. I say "cheap" because it captures none of the excitement of the original—it's not cheap, in the true financial sense, at \$34.95. And I call it an "attempt" because it looks half-finished. **Flak** could be the worst mistake your wallet ever made; avoid it like radioactive waste.

In **Xevious**, you swooped in low over magnificent cartoon-like graphics, using air-to-ground bombs to decimate oncoming fighters, saucers, bunkers and tanks, on your way to a climactic encounter with the monster mother ship. In **Flak**, you fly over adequate vertically-scrolling landscape, firing upon land bases only, on your journey to do battle with the mad CPU (give me a break). It seems as though someone made a start at copying **Xevious** and, for whatever reason (copyright, time, money, expertise) found they could not do it...but they sold the partially finished product, anyway.



Flak.

There are more problems. Flak places you, when destroyed, near your last position in play. However, this often results in your being right above a firing bunker. Poof! Without a chance, you're a pulsating fireball (that's my imagination; the graphics aren't that good).

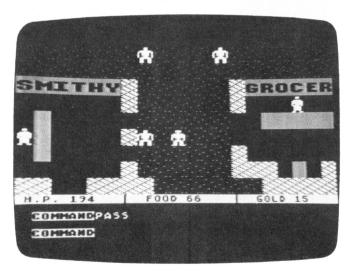
The documentation is poor, in the truest sense of the word. The manual looks almost photocopied. If that isn't enough of a curse, the book then makes a pitiful effort to create an interesting background history for the game. Again, Flak fails miserably.

As if you'd want one, it gives you an extra life every 10,000 points; fortunately, I rarely reached that level of expertise. The sound effects are barely above those of the earliest **Pong** game, and they affect the human nervous system in a manner similar to new chalk scraped down a blackboard.

Flak is truly a book to judge by its cover. . . and a good argument in favor of book burning. When the best thing you can say about a game is that it has adequate graphics, you know it's in trouble. My sympathy to anyone who's stuck with this dog.

#### QUESTRON STRATEGIC SIMULATIONS, INC. 883 Stierlin Road Mountain View, CA 94043 48K Disk \$49.95

Questron is a meaningless Xerox copy of Ultima, with a few new twists scattered throughout. However, it does cover well-worn ground in a competent way, and would make a fine first and/or only addition of a role-playing game to your software library.



#### Questron.

In Questron, you start the game as a lowly serf. The only characteristic you can control is your name, while the computer assigns the familiar D&D attributes of strength, intelligence, etc. Then, it's off to travel, battle, plunder, loot, kill and maim in the quest for fame and fortune. Over fine-scrolling graphics, you travel to cathedrals, towns, ports and dungeons. You pray to be healed, buy and sell goods, and search for treasures. An amusing addition to this formula is the gambling parlor. These are found in many of the towns and allow you to quickly increase (or, more likely, lose) your gold holdings.

The graphics are nearly identical to those in **Ultima**: top view maps of landscapes, towns and buildings; first person point of view line vector graphics in the dungeons. All graphics are good, although not very original—the biggest problem with this game.

We've seen all this before. We need another **Ultima** no more than we need another **Pac-Man**. With no unique quest in mind, plot development only in the form of short sentences (usually the same in every town) and endless battles, the game is like a Twinkie without the creme filling—an attractive exterior hiding absolutely nothing.

Another irritant is the number of disk swaps necessary to play **Questron**. While I don't mind waiting for my slow 810 to feed my starving 800 the required data, continually changing disks drives me into a frenzy. Normally, the solution is two drives (for those of us who have the cash reserves), but the manual says nothing about two-disk support. A call to the SSI technical hotline netted me the response that only one drive could be used with the Atari version of **Questron**. Those with two drives are as powerless here as we who have only one.

But **Questron** is well done and shows a lot of effort. It only fails for me because I have done it all before, many times. **Ultima** excited me, spurred me to finish it in record time—a dollar (or more) well spent. **Ultima II** I never finished. I had quested to destroy evil once before. Without more filler to create a more real universe, I quickly lost interest. Even with the extensive documentation that supplies the game with a history and describes its monsters and attributes, the voyage was shallow for me...like wading into the water but never having to battle to keep my head above the waves.

Still, I feel no qualms about recommending **Questron** as a first adventure of this type. If you are considering it as your second or third adventure and are looking for something different, then (at \$49.95) it would serve you well to examine **Questron** closely before buying.

#### In retrospect.

We have looked at a number of games here, all of different types. From the superb prose of **Infidel** to the abysmal machine language mess called **Flak**, we've observed the best and worst characteristics in current software.

Using this as a guide, go out and look for yourself, digging into and scrutinizing the disks, cassettes and cartridges in search of real quality. Only through careful purchasing habits can we avoid the unpleasant feeling we all know—that of wasting our time and money on a worthless bit of rubbish.

The author would like to thank Perfect Computers of Nile, Ohio, for valuable assistance in the creation of this article.

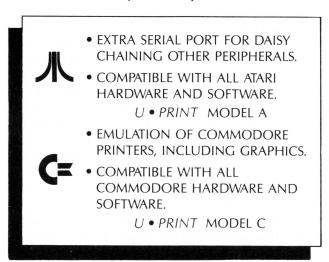
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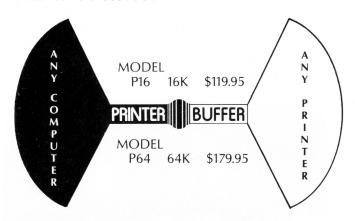
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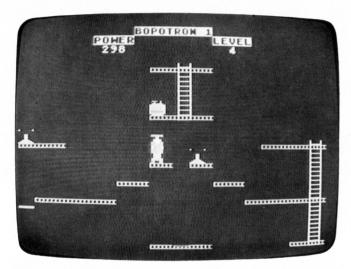
#### by Kyle Peacock

Mankind has finally abandoned its futile efforts to establish the nuclear superiority of any one nation. The major powers have joined together for the sake of scientific advancement rather than political dominance. Space exploration has become the major interest of today's society. Unfortunately, the fantasies of warp drive and speed-of-light travel are still unattainable ideals. Cryogenics and patience are the only feasible methods of reaching the stars.

You are a small worker, **Bopotron**, on the starship Quab IV. While the crew lies in suspended animation, your job is to handle minor maintenance and repairs. It's just your luck that Ted, the last human to enter the cryogenic vault, left the ship in an uproar. The control platforms that allow **Bopotron**s to move about are on full automatic, and many of the ship's power units are on constant drain.

Being a noble Bopotron, you set out to perform

a task that will last through the next four centuries. You are responsible for the recharging of the drained power units. Each unit requires 100 EUs (energy units) to function properly. Charging a unit drains your own internal supply, so you'll have to juice up at one of the ship's power packs periodically. Should you fail to keep your own internal power above zero, you'll no longer be able to function, the ship will go dead and everyone on board will be iced. (*Aren't they already?* —Ed.)



Bopotron.

**Bopotron** is a one-player game written in BASIC, with assembly language subroutines. The game begins with the player receiving five lives to complete all the levels. This magazine version has only five levels. Future levels can be added via the use of the **Bopotron Construction Set** (see page 55).

The screen layout for **Bopotron** is pretty straightforward. Girders and ladders are safe areas to bop (travel) on. Power packs are represented by small, glowing batteries with plus and minus terminals. To charge up, all you must do is stand on either side of a power pack. Power units more or less resemble television antennas. Standing next to one will discharge your internal power supply while charging the unit. Once a unit is fully charged, it will glow rapidly. Fully charged units require zero maintenance and expend none of your energy. Once you've charged up all of the power units on a particular level, you can leave the level by bopping onto the exit girder (a small, glowing girder segment somewhere on the screen).

The framework of the Quab IV is non-contiguous; not all of the ladders and girders connect. For this reason, the Quab engineers have provided maintenance platforms to aid the **Bopotrons**. These platforms travel in a pre-programmed manner at regular intervals. Whenever you bop onto a platform, it will carry your **Bopotron** along its pre-programmed vector. The use of such platforms is essential for completing your task.

Although mechanical, a **Bopotron** is extremely fragile. It will be destroyed under one of two conditions: (1) the **Bopotron** falls a long distance off of a girder, ladder or platform; or (2) the **Bopotron**'s brain bubble (located at the top of its head) is struck by a girder or platform. Should one of these conditions arise, it's bye-bye **Bopotron**.

Although pretty much an "as is" game, **Bopotron** does allow for slight variations. Examination of Line 160 in the program listing reveals the following variables:

MAXLIFE — This is the maximum number of **Bopotron** lives per game. No extra lives are awarded. This value should be kept below ten.

MAXFALL — This is the maximum number of character segments the **Bopotron** can fall before dying. The height of one girder is four character segments. So, as an example, if MAXFALL equals twenty-four, your **Bopotron** can fall the height of six girders before dying.

MAXLEVEL — This is the maximum number of levels in the game. As levels are added, this number would increase. Those with only 16K cannot add levels without first deleting already existing ones.

STARTLEVEL — This is the starting level of the game. Should you wish to skip levels one, two and three, set STARTLEVEL equal to four.

Once again, I'd like to thank Tom Hudson for his assistance on **Bopotron**. Levels one, two and five are of my own design, while levels three and four were concocted by Tom. You just can't keep a good programming team down. Keep on boppin'!

#### BASIC listing.

```
100 REM ***********
110
       REM
                           BOPOTRON
                    KYLE PEACOCK
ANALOG COMPUTING
120
       REM
       REM
140
150
       REM
       REM
       MAXLIFE=5: MAXFALL=11: MAXLEVEL=5: ST
160
ARTLUL=1:LUL=STARTLUL
170 READ N1,N2,N3,N4,N5,N6,N7,N8,N9,N0
180 DIM UBLANK$(723),INIT$(103),DLI$(1
2),BOP$(30):LIFE=N1
190 POKE 106,PEEK(106)-N4:CSET=PEEK(10
6)*256:GRAPHICS 0:POKE 1536,CSET/256:P
OKE 54286,192:POKE 752,N1:GOSUB 610
200 VBLANK=ADR(VBLANK$):BOP=ADR(BOP$):
INIT = ADR (INITS
210 FOR X=N1 T
                       TO 723:READ N:UBLANK$(X)=
CHR$ (N) : NEXT
                        X
TO 103:READ N:INIT$(X)=CH
220 FOR X=N1
R$(N):NEXT X
230 FOR X=N1 TO 12:READ A:DLI$(X)=CHR$
(A):NEXT X:X=ADR(DLI$):HIGH=INT(X/256)
LOW=X-HIGH*256
240 POKE 512,LOW:POKE 513,HIGH
250 FOR X=N1 TO 30:READ N:BOP$(X)=CHR$
(N):NEXT
260 PMBASE=INT((PEEK(145)+N3)/N4)*N4:P
OKE 54279,PMBASE:PMB=PMBASE*256:POKE 5
59,46:POKE 53277,N3:POKE 623,33
270 FOR X=K0 TO 127:READ A:POKE CSET+N
8+X, A:NEXT X
```

```
280 DLIST=PEEK (561) *256+PEEK (560) : POKE
 DLIST+N8, N2+128:FOR X=DLIST+N9 TO DLI
ST+28:POKE X,N4:NEXT X
290 K=INT(RND(N1)*16):SETCOLOR N2,K,N2
:SETCOLOR N4,K,N2:FOR X=K0 TO N3:SOUND
    X,K0,K0,K0:NEXT X
 300 REM
 310 REM *** CONSTRUCT BOARD ***
 320 REM
330 GOSUB 4000:GOSUB 5000:GOSUB 6000:G
 05UB 7000:G05UB 8000:G05UB 2000:G05UB
3000:P0KE 54286,192
 340 GOSUB 610:POKE 1537.KO
 350 REM
 360 ŘEM *×∗ GET THINGS GOING
 370 REM
 380 POSITION NO, N2:? ENG;" ";:POKE 77,
 390 V=PEEK(1537):CHAR=PEEK(1612):TRIG=
 STRIG(K0)
400 IF V=K0 AND ENG>K0 THEN 440
410 POKE 1537,N1:FOR X=K0 TO 255 STEP
N5:SOUND N1,X,N8,N0
420 K=INT(RND(N1)*256):T=INT(RND(N1)*N
420 K=INT(RND(N1)*256):T=INT(RND(N1)*N
3):SETCOLOR N2,K,K:SETCOLOR N4,K,K:POK
E 53256,T:POKE 53257,T:NEXT X
430 SOUND K0,K0,K0;K0:SOUND N1,K0,K0,K
0:LVL=LVL-M1:LIFE=LIFE+N1:GOTO 580
440 SOUND K0,200-100*(STICK(0) <>15)-50
*(TRIG=K0),N6,N8
450 IF CHAR(12 OR CHAR)13 THEN 530
460 X=INT((PEEK(1541)-45)/N4):Y=INT((PEK(1545)-N6)/N4):SOUND K0,K0,K0,K0
470 FOR R=255 TO K0 STEP -N5:SOUND N2,
R,N0,N0:SOUND N3,R+N1,N0,N0:ENG=ENG-N2
480 POSITION N0,N2:? ENG;"";:T=PEEK(1
612):IF T(12 OR T)13 THEN 520
490 NEXT R
500 POSITION X-(N1*(CHAR=13))+(N1*(CHA
R=12)),Y:?"
510 POSITION X-(N1*(CHAR=13))+(N1*(CHA
R=12)),Y-N1:?"
520 SOUND N2,K0,K0,K0:SOUND N3,K0,K0,K0
530 IF CHAR<136 OR CHAR>137 THEN 550
540 IF ENG<=MAXENG THEN ENG=ENG+N0:FOR
X=15 TO K0 STEP -N2:50UND N1,200,N0,X
:NEXT X:GOTO 560
EEG ENG=N0=N2*/TDTG=K03
 550 ENG=ENG-N1-N2*(TRIG=K0)
560 IF CHAR<>144 OR ACTIVE<>K0 THEN 38
 570 POKE 1537,N1:FOR T=K0 TO N4:FOR X=
K0 TO 255 STEP 20:SOUND K0,X,N0,N0:SOU
        N1,X+N1,N0,N0:NEXT X:NEXT
 580 POKE 1537, N1: FOR X=K0 TO N3: SOUND X, K0, K0, K0: POKE 53248+X, K0: NEXT X: GOSU
      660
B 660
590 LVL=LVL+N1*(LVL <> MAXLEVEL):IF LIFE
>MAXLIFE THEN 630
600 GOTO 290
610 POSITION 14,0:? "BOPOTRON"; CHR$(L
IFE+176):POSITION N9,N1:? "POMER":POSI
TION 24,N1:? "EVEL"
620 POSITION 26,N2:? LVL;:RETURN
630 LIFE=N3:GOSUB 610:POSITION N1,N3:?
"GAME OVER - PRESS BUTTON TO PLAY AGA
TM":SETCOLOR N2,KA,KA
 IN": SETCOLOR N2, K0, K0
640 IF STRIG(K0) THEN 640
 650 GOSUB 660:LVL=STARTLVL:LIFE=N1:GOT
 0 290
 660 POSITION K0,N2:FOR X=K0 TO 24:? "[]
 ";:NEXT X:RETURN
 1000 REM
1010 REM *** CONSTANTS
 1020 REM
1030 DATA 1,2,3,4,5,6,7,8,9,10
 1040 REM
 1050 REM *** VERTICAL BLANK ROUTINE
 1060 REM
1060 REM

1070 DATA 216,238,199,2,173,1,6,240,3,76,98,228,165,203,72,165,204,72,160,0,162,0,189,5,6,157,0,208

1080 DATA 189,9,6,141,2,6,24,113,205,141,3,6,200,140,4,6,224,0,240,13,165,203,24,105,128,133,203,165

1090 DATA 204,105,0,133,204,173,2,6,56,233,10,168,169,0,145,203,200,204,2,6,144,248,173,3,6,24,105,10
```

1360 REM
1370 DATA 216,165,16,41,127,133,16,141
,14,210,104,104,141,79,6,104,141,80,6,
104,133,204,104,133,203,104
1380 DATA 133,206,104,133,205,169,1,14
1,1,6,165,204,72,162,3,160,0,152,145,2
03,200,208,251,230,204,202
1390 DATA 16,246,162,9,157,25,6,224,4,
176,3,157,13,6,202,16,243,141,82,6,141,17,6,141,19,6
1400 DATA 141,20,6,142,78,6,169,5,141,18,6,104,133,204,174,79,6,172,80,6,169,7,76,92,228
1410 REM \* 103 BYTE5
1420 REM 1360 REM 1420 REM 1430 REM \*\*\* DLI ROUTINE

```
1440 REM
1450 DATA 72,173,0,6,141,10,212
1460 DATA 141,9,212,104,64
 1470 REM
1480 REM *** PLAYER IMAGE DATA ***
 1490 REM
1500 DATA 12,126,0,60,126,126,126,126
1510 DATA 126,0,0,0,102
1520 DATA 12,0,24,60,24,0,66,0,0,60
1530 DATA 60,126,0
1540 DATA 1,255
                     1,255
1550 DATA
1560 REM
1570 REM *** CHARACTER DATA
 1580 REM
1590 DATA 0,0,0,0,85,68,68,85
1600 DATA 8,8,8,10,89,72,72,90
1610 DATA 0,0,0,170,85,68,68,170
1620 DATA 128,128,128,149,132,132,
149
1630 DATA 8,8,8,10,8,8,8,10
1640 DATA 0,0,0,170,0,0,170
1650 DATA 128,128,128,128,128,128,
 128
                     191,191,170,42,85,68,68,85

254,254,170,168,85,68,68,85

63,12,21,170,170,150,170,170

48,48,84,170,154,86,154,170

2,10,42,170,85,68,68,85

128,160,168,170,85,68,68,85

128,60,12,15,2,61,2,253

2,60,48,240,128,124,128,127
 1660 DATA
 1670 DATA
 1680 DATA
 1690 DATA
 1700 DATA
 1710 DATA
 1728 DATA
 1730 DATA
1740 DATA
                     0,0,0,0,255,204,204,255
2000 REM
 2010 REM *** SET UP BOPOTRON
 2020 REM
2030 POKE 704,102:POKE 53256,K0
2040 POKE 705,136:POKE 53257,K0
2050 POKE 706,151:POKE 707,231:POKE 16
 19, MAXFALL
17, THAT HLL
2060 RESTORE 2080+(20*LVL)
2070 READ X,Y,ENG,MAXENG:POKE 1541,X*N
4+48:POKE 1542,X*N4+48:POKE 1545,Y*N4+
N6:POKE 1546,Y*N4+N6
2080 RETURN
2100 DATA 0,4,500,500
2120 DATA 37,23,200,500
2140 DATA 0,12,300,500
2160 DATA 16,13,300,500
2180 DATA 37,23,300,650
 3000 REM
 3010 REM *** 'EXIT' GIRDER
 3020 REM
3030 RESTORE 3080+(20*LVL)
 3040 READ X,Y:POSITION X,Y:? "[]";:RETU
RN
3100 DATA 0,4
3120 DATA 0,23
3140 DATA 38,5
3160 DATA 23,23
3180 DATA 35,5
4000 REM
4010 REM *** FLOOR DRAW
4020 REM
 4030 RESTORE 4080+(20*LVL)
4030 RESTURE 4080+(20*LVL)
4040 READ AMOUNT:FOR T=N1 TO AMOUNT:RE
AD STRT,END,YPOS:FOR X=STRT TO END:POS
ITION X,YPOS:? "!";:NEXT X:NEXT T
4050 RETURN
4100 DATA 9,0,8,4,17,26,4,3,13,9,16,23
,9,30,35,9,7,13,13,16,35,13,7,30,18,0,
38,23
4120 DATA 9,7,15,7,18,23,7,14,15,12,18
,19,12,6,10,16,23,28,16,35,36,16,2,5,1
4121 DATA 38,23
4140 DATA 8,0,5,5,0,5,13,0,5,23,34,38,5,34,38,13,34,38,23,12,19,9,22,27,9460 DATA 12,16,23,4,16,23,9,0,5,12,30,38,12,16,18,14,21,23,14,12,15,16,24,27,16,2
4161 DATA 11,18,28,38,18,34,38,23,16,2
3,23
4180 DATA 20,22,27,5,7,13,8,16,17,8,18,19,9,20,21,10,30,35,10,22,23,11,24,25
```

4181 DATA 13,13,26,27,13,28,29,15,30,3
1,16,32,33,17,34,35,18,20,21,19,18,19,
20,11,17
4182 DATA 21,9,10,22,2,8,23,32,38,23 5000 REM 5000 REM
5010 REM \*\*\* LADDER DRAW
5020 REM
5030 RESTORE 5080+(20\*LVL)
5040 READ AMOUNT:FOR T=N1 TO AMOUNT:RE
AD STRT,END,XPOS:FOR Y=STRT TO END:POS
ITION XPOS,Y:? "X&";:NEXT Y
5050 POSITION XPOS,STRT:? CHR\$(34);"#\$
";:POSITION XPOS,END:? CHR\$(34);"#\$";: NEXT T 5060 RETURN 5100 DATA 4,4,9,27,9,13,36,13,18,4,18, 23,31 5120 DATA 4,12,16,11,12,16,20,19,23,6, 16,23,29 5140 DATA 2,13,23,1,13,23,36 5160 DATA 3,4,9,19,18,23,36,12,18,36 5180 DATA 3,5,16,36,18,23,36,8,13,2 6000 REM 6010 REM \*\*\* BATTERY DRAW 6020 REM
6020 REM
6030 RESTORE 6080+(20\*LVL)
6040 READ AMOUNT:FOR T=N1 TO AMOUNT:RE
AD XPOS,YPOS:POSITION XPOS,YPOS:? "[]" 6050 POSITION XPOS, YPOS-N1:? "EE";:NEX T T:RETURN 6100 DATA 1,0,23 6120 DATA 1,14,23 6140 DATA 1,34,13 6160 DATA 1,16,9 6180 DATA 1,0,23 7000 REM 7010 REM \*\*\* POWER UNIT DRAW 7020 REM 7030 RESTORE 7080+(20\*LVL)
7040 READ ACTIVE:FOR T=N1 TO ACTIVE:RE
AD XPOS,YPOS:POSITION XPOS,YPOS:? ",-" 7050 POSITION XPOS, YPOS-N1:? "./";:NEX T:RETURN 7100 DATA 2,3,9,23,9
7120 DATA 2,4,16,37,16
7140 DATA 2,0,5,12,9
7160 DATA 2,0,12,21,14
7180 DATA 4,20,5,0,8,8,13,10,13 8000 REM 8010 REM \*\*\* PLATFORM PROGRAMMING 8020 REM 8030 A=USR(INIT,VBLANK,PMB+512,B0P) 8040 RESTORE 8080+(20\*LVL) 8050 READ NUMPLAT:FOR A=N1 TO NUMPLAT: ADD=K0+N5\*(A>N1):READ NUMVEC:FOR B=N1 TO NUMVEC 8060 READ STARTX,STARTY,XEND,YEND,SPEE D:STARTX=STARTX\*N4+48:STARTY=STARTY\*N4 +18:XEND=XEND\*N4+48:YEND=YEND\*N4+18 8070 IF B=N1 THEN POKE 1541+N1+A, START X:POKE 1545+N1+A, STARTY 8080 POKE 1561+ADD, SPEED:POKE 1571+ADD, STARTY:POKE 1581+ADD, STARTY:POKE 1591+ADD, XEND:POKE 1601+ADD, YEND 8090 ADD=ADD+N1:NEXT B:POKE 1614, NUMPL AT-N1:NEXT A:RETURN 8100 DATA 2,3,14,17,14,9,2,14,9,14,13, 1,14,13,14,17,1,2,9,4,15,4,1,15,4,9,4, 3 8120 DATA 2,4,16,23,16,4,3,24,7,34,23, 2,16,4,16,23,3,24,7,34,23,4,4,7,12 8121 DATA 24,12,2,5,7,0,17,1,24,12,7,1 2,2,5,7,0,17,1 8140 DATA 2,5,18,9,18,5,2,18,5,6,5,2,6 ,5,6,23,2,6,23,18,23,2,18,23,18,23,1,5 ,20,23 8141 DATA 32,23,2,32,23,37,5,2,37,5,28 ,20,23
8141 DATA 32,23,2,32,23,32,5,2,32,5,20
,5,2,20,5,20,9,2,20,23,1
8160 DATA 2,3,0,19,0,23,1,0,23,32,23,1
,28,13,24,13,2,4,19,23
8161 DATA 19,14,1,37,12,24,4,2,14,4,6,
12,2,6,12,6,18,2
8180 DATA 2,4,30,23,14,18,2,5,8,5,8,3,
5,8,5,14,2,28,14,28,5,2,3,8,23
8181 DATA 14,8,2,14,8,14,8,3,28,5,34,1

#### CHECKSUM DATA.

(see page 90)

100 DATA 35,417,588,935,47,89,580,742,892,697,20,988,307,835,973,8145
250 DATA 242,395,500,710,508,78,180,84
,545,250,93,892,99,323,34,4933
400 DATA 80,149,420,691,611,513,927,63
8,552,779,800,388,257,617,615,8037
550 DATA 645,84,648,336,621,722,256,67
1,886,399,182,776,275,130,2277,6908
1030 DATA 309,279,686,281,141,301,180,38,880,760,477,858,898,581,593,7262
1180 DATA 149,632,501,574,782,30,433,5
14,278,757,167,889,901,127,368,71102
1330 DATA 522,288,353,290,621,357,246,133,513,289,156,291,597,848,294,5798
1480 DATA 366,296,184,516,700,172,893,894,296,557,298,206,410,410,382,6580
1630 DATA 70,75,385,18,242,18,259,711,20,626,237,628,277,864,279,4909
2030 DATA 825,848,930,183,978,789,435,527,700,5224,547,279,195,281,185,8226
3040 DATA 588,825,666,683,276,496,4281,947,283,190,64,790,367,311,882,8435
4140 DATA 675,686,503,220,549,928,283,76,285,195,23,573,793,796,95,6680
5140 DATA 283,916,698,285,593,287,200,973,442,110,973,977,154,118,287,7296,7010 DATA 989,289,205,375,824,264,712,254,683,578,289,583,291,540,211,7087
8050 DATA 677,403,84,439,975,729,381,5

#### Assembly language listing.

```
BOPOTRON **
by Kyle 9. Peacock **
ANALOS COMPUTINS **
                                                     ZERO PAGE USAGE *
        PLADR
PMSTR
SCREEN
                                                                                                                                                                *CB
*CD
*CF
                                                                                                                                                                                                                                                                   ADDR PLR AREA
ADDR PLR DATA
ADDR OF SCREEN
                         BREAK DISABLE
SCREEN ADDR.
JOYSTICK PORT
COLDR REG. #3
HOR. POS. PL%
JOYSTICK BUTTON
IRANDOM NO.
BREAK DISABLE
ICHAR BET ADDR
WAIT FOR SYNC.
JEST VBLANK
JEND OF VBLANK
                                                                                                                                                                $18
$5827088
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    POKMSK
SAVMSC
STICK
COLOR3
HPOSPØ
TRISØ
RANDOM
IRGEN
        CHBASE
                       IVBLANK ACTIVE
IPLR Y START
IPLR Y START
IPLR Y ENDITER
IPLRE X-COORDS.
IPLRE Y-COORDS.
INOVEMENT TIMER
INOVEMENT TIMER
IX-REG. HOLD
ION PLAT. FLB
INOW FAR TO FALL...
                                                                                                                                         ; CHILL DECIMAL.; DISABLE BREAK; KEY. THE BREAK
                                                                                                                   CLD
LDA POKMSK
AND ##7F
```

```
STA POKMSK
STA IRQEN
STA IRQU
STA I
CLEAR
                                                                                                                              STA (PLADR), Y : CLEAR PMS
INY
BNE CLEAR ; ALL DONE?
DEX
JALL DONE?
JALL DONE
CLEAR2
                                                                                                                                 STA SPEEDS, X ; CLEAR OLD
CPX ***# ; MOTION TIMERS
BCS CLEARJ ; & STATUS. PRE
STA STATUS, ; PARE FOR NEW
                                                                                                                              DEX | DATA CONTROL |
BPL CLEAR2 | INFORMATION. |
STA FALLCUNT |
STA PARTED+# | STOP PREVIOUS |
STA XSPEED+# | STOP PREVIOUS |
STA YSPEED+# | STOP PREVIOUS |
STA PARTH | SOU!!!!!!
STA PARTH | STOP PREVIOUS |
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CLEAR3
                                #= $2000
PHA
LDA $0600
STA WSYNC
STA CHBASE
PLA
RTI
                                                                                                                                                                                                                                                                                                             ; SAVE ACC.
; CHR. HI/BYTE.
; WAIT A WHILE.
; SAVE CHR. SET.
; RESTORE ACC.
; BOOGIE...
                                                          CLD ; CHILL DECIMAL.
INC COLOR3 ; CHANGE COLOR.
LDA ACTIVATE ; VBLANK ACTIVE?
BEQ FUNCTION ; YES! BRANCH!
JMP XITVBV ; NO. LATER.
  FUNCTION
                                                                                                                                 LDA PLADR ;PLR ADDR. LO.

PHA ;SAVE IT.

LDA PLADR+1 ;PLR ADDR. HI.

PHA ;SAVE IT.

LDY **## ;BLANK Y RES.

BLANK Y RES.
                                                                                                                              LDA ***60 ; BLANK X REG.

LDA XPOS X ; PLR X-POS.

TA HPOSPO X ; PTR Y-POS.

TA STA THOUSE X ; PTR Y-POS.

TA STA THOUSE X ; PTR Y-POS.

TA STARTPT ; SAVE IT.

LDC YPOSPO X ; PTR Y-POS.

TA STARTPT ; SAVE IT.

GET PLAYER

HOVE TO 18 TO THOUSE TO 
  DRAW5
  PASSØ
                                                                                                                                 LDA STARTPT
SEC
SBC #10
TAY
LDA ##00
                                                                                                                                                                                                                                                                                                          ;STARTING PT.
;SUBTRACT 18
;BYTES.
;MOVE TO Y-REG.
;CLEAR ACC.
                                                                                                                         INSERT1
  INSERT2
                                                                                                                                 STA (PLADR),Y ;STORE BLANK
DEY ;MOVE TO NEXT.
CPY ENDPT ;AT END?
BCS INSERT2 ;NO. BLANK MORE.
                                                                                                                              PASS1
  BACKUP
                                                                                                                                                                                                                                                                                                             BRANCH POINT.
                                                                                                                                 BCC DRAWS
  PASS2
                                                                                                                                      LDY DATAPT ; BET POINTER.
LDA (PMSTR), Y ; BET PLR DATA.
  PASSX
```

```
STARTPT : GET START PT.

(PLADR), Y : PUT IT PLR AREA
STARTPT : IMC. AREA PTR.
STARTPT : IMC. DATA PTR.
STARTPT : GET AREA PTR.
ENDPT : AT END?
PASS1 : NO. BRANCH.
STATUS, X : GET STATUS.
OUT : IF >= Ø BRANCH.
STATUS, X : SET STATUS.
OUT : VES. BRACH.
PASS1 : SAVE STATUS.
OUT : VES. BRACH.
STATUS, X : SET PNTR.
XSTATUS, X : GET PNTR.
XSTARTY : GET X-START
XPOS X : SAVE AS X-COORD
YSTART, Y : GET YSTART
YPOS X : SAVE AS Y-COORD
e15 : IPAUSE FDR A
XSPEED-2, X : MHLLE.
DATAPT : IBETORE Y-PER.
                                                                                                                                                                                                                                                              LDA XPOS+2,X ;COMPARE DESTINCHP XEND,Y ;ATION TO ACTUAL BCC PLUSIX ; POSITION.
BEQ NEMDELTA ;
LDA 05FF ;DELTA IS -1.
BHI SETDELTAY
                                                                                                                                                                                                                   PLUS1X
                                                                                                                                                                                                                                                               LDA #9#1
                                                                                                                                                                                                                                                                                                                       DELTA IS +1
                                                                                                                                                                                                                  SETDELTAX STA DELTAX, X | SAVE X-DELTA.
                                                                                                                                                                                                                                                             LDA YPOS+2,X;COMPARE DES-
CMP YEND Y ITINATION TO
BCC PLUSTY ACTUAL POSITION
BEQ DELTASDONE
LDA 00FT | IDELTA IS -1
BMI SETDELTAY
                                                                                                                                                                                                                  ETDELTAY
                                                                                                                                                                                                                                                                                                                        IDELTA IS +1
                                                                                                                                                                                                                   STA DELTAY, X : SAVE Y-DELTA.
דעם
                                            LDY DATAPI
INX
CPX ###4
BCC BACKUP
PLA
STA PLADRE
PLA
STA PLADRE
                                                             DATAPT | RESTORE Y-RES. | MOVE TO NEXT. | SACKUP | NO. BRANCH. | RESTORE OLD | PLADR+1 | PLADR | POINTERS. | POINTERS.
                                                                                                                                                                                                                                                              DEX CHECK NEXT
BPL SLIPTEST ;PLATFORM.
                                                                                                                                                                                                                           LDA SAVMSC | SET 1st ADDR.

STA SCREEN | DF SCREEN |
LDA SAVMSC+1 | MEMORY & SAVE
STA SCREEN+1 | IT.
LDA YPOS | BOPOTRON Y.
SEC | SUBTRACT SEX |
LSR A | DIVIDE BY FOUR.
LSR A | MOVE TO X-RES.
                                                                                                                                                                                                                   PASSS
          LDX TASKERS : # OF PLATFORMS.
BMI FORWARD : NONE. BRANCH.
                                            DEC X8PEED, X ITIME TO MOVE?
BNE FORWARD IND BRANCH.
LDA STATUS+2 X IPLAT ALIVE?
BEQ SELECT IVES. BRANCH.
LDA #0FF ISET UP FOR NEW
BTA STATUS+2, X IVECTOR.
BMI FORWARD IBRANCH.
                                                                                                                                                                                                                   PASS4
                                                                                                                                                                                                                                                             BEQ PASSILDA SCREEN
CLC #48
STA SCREEN
LDA SCREEN
ADC #588
STA SCREEN
DEX BPL PASS4
                                                                                                                                                                                                                                                                               PASSS | IF = # BRANCH.
SCREEN | SET SCREEN | ADD ONE LINE.
| 44# | (4# BYTES) |
SCREEN | SAVE | IT SCREEN | CORRECT FOR |
| 59# | PASS MRAP-
| SCREEN | I AROUND. |
| AT BOPDTRON'S |
| PASS | Y-COORD?
SELECT
                                                             PMTR X + BET PNTR.
SPEEDS, Y + BET PLAT SPEED
XSPEED, X + 18AVE IT.
PDS+2, X + 15AVE IT.
END. Y + DESTINATION?
ADDUP + ND. BRANCH.
YPOS+2, X + NOW CHECK
YEND.Y + NOT THERE. BRANCH.
BTATUS+2, X + TO ONE.
STATUS+2, X + TO ONE.
STATUS+3, X + TO 
                                                                                                                                                                                                                   PA995
                                                                                                                                                                                                                                                                                                                        YES. GET

IX-COORD & SUB-

ITRACT 44.

DIVIDE BY

FOUR.

MOVE TO Y-RES.

Y [CHARACTER 9.

IBDPOTRON ON

PLATERM?

JYES! CHAR=1.
                                                                                                                                                                                                                                                                                 XPOS
                                                                                                                                                                                                                                                                                #44
A
A
                                                                                                                                                                                                                                                                                (SCREEN)
SLIP
PASS6
##91
                                              BPL LOADS
BACKTRACK BPL START
                                                                                                                                                                                                                                                             PA886
                                             BED NEXT
                                                                                                         BRANCH POINT.
LOADO
                                            INC PNTR, X
LDA PNTR, X
CMP #985
BNE LOAD1
LDA #988
BEQ LOAD2
                                                                                                       #AT DESTINATION.
#TIME TO SET
#NEXT PREPROS-
#RAMMED VECTOR.
#BUT DON'T SET
#VECTOR IF IT
LDAD1
                                                                                                         IS NOT VALID.
IF INVALID.
KEEP SEARCHING
1 DADO
                                            STA PNTR, X ; FOR VALID TAY ; VECTOR. LDA SPEEDS, Y BEQ LOADS BPL NEXT
                                                                                                                                                                                                                   PA887
                                         BPL NEXT

LDA XPDS+2, X IADD PROPER
CLC

ADC DELTAX, X IFORM X-COORD.
STA XPDS+2, X IADD PROPER
CLC

ADC YPDS+2, X IADD PROPER
CLC
ADC DELTAY, X IFORM Y-COORD.
STA YPOS+2, X IADD PROPER
CPX SLIP
ISOPOTRON ON
BME NEXT
LDA XPOS
ITA XPOS
STA XPOS
IAND SAVE IT.

BOP-
STA XPOS
IAND SAVE IT.

IAND SAVE IT.

IAND SAVE IT.

IAND SAVE IT.

IAND Y-DELTA TO
ADDUE
                                                                                                                                                                                                                                    LDA CHAR ;GET CHARACTER *
BEQ FALL ;IF = # BRANCH.
DEC MOVETIME ;DEC TIMER.
BMI MOTION ;IF <# MOVE.
JMP XITVBV ;ELSE, QUIT.
                                                                                                                                                                                                                   MOTION
                                                                                                                                                                                                                                                                                                                         #SAVE ACC.
#RESET TIMER.
#18 BUTTON HELD?
#NO. BRANCH.
#YES. MOVE FAST.
                                                                                                                                                                                                                                                              PHA
LDA ###1
LDX TRIGO
BEQ RESET
ASL A
                                                               DELTAX,X
XPO8
XPO8+1
YPOS
                                                                                                      ; ADD Y-DELTA TO
; BOPOTRON
(;Y-COORD AND
; SAVE IT.
                                                                                                                                                                                                                   RESET
                                                                                                                                                                                                                                                             STA MOVETIME | SAVE TIMER.
PLA | RESTORE ACC.
CMP #4#2 | IS CHARACTER <
BCC FALLTEST | IF YES BRANCH
CMP #4#8 | IS CHARACTER <
BCC CHECK6 | IF YES BRANCH.
                                                               DELTAY, X
YPDS
YPOS+1
NEXT
                                             DEX HANDLE NEXT BPL BACKTRACK PLATFORM.
                                                                                                                                                                                                                   FALLTEST
                                                                                                                                                                                                                                                                                                                         ION PLATFORM?
IF YES BRANCH.
NODIFY BOPO-
ITRON'S Y-COORD
SO HE'S ALWAYS
ON TOP OF A
SIRDER.
                                                                                                                                                                                                                                                              LDA SLIP
BPL CHECKS
LDA YPOS
AND ###1
BNE FALL
LDA YPOS
AND ###3
BNE CHECKS
           LDA #9FF ;CLEAR 'ON
STA SLIP !PLATFORM' FLAS
LDX TASKERS ;# OF PLATFORMS
BMI DELTASDONE ;NONE. QUIT.
                                                                                                                                                                                                                   FALL
                                                                                                                                                                                                                                                               INC FALLCOUNT ; FALLING..
LDA #491 ; ADD ONE TO
BNE ADDY ; Y-COORD.
SLIPTEST
                                                                                                      | SUBTRACT BOPO-
| TRON X-COORD
| FROM PLATFORM'S
| IF >= # BRANCH.
| TAKE # BBSOLUTE
| VALUE.
                                                              KPDS
                                                               XPDS+2,X
NDABS
##FF
                                                                                                                                                                                                                   CHECK6
                                                                                                                                                                                                                                                                                                                         BET JOYSTICK.
PUSHED DOMN?
INO. BRANCH.
IS Y-COORD AT
ILOWER LIMIT?
INO. BRANCH.
                                                                                                                                                                                                                                                                               8T1CK
#13
CHECK7
YPD8
#98
                                            BPL
EOR
CLC
ADC
                                                              **#1
NOARS
                                           BNE FALL
BER CHECKS
                                                                                                                                                                                                                   CHECK7
                                                                                                                                                                                                                                                                                                                           PUSHED UP?
NO. BRANCH.
SET TO MOVE UP.
                                                                                                                                                                                                                   ADDY
                                                                                                                                                                                                                                                                                                                         ; ADD MOVEMENT
; DELTA TO BOP-
; OTRON'S Y-COORD
; AND SAVE IT.
                                                                                                                                                                                                                                                                                YPD8
YPD8
YPDS+1
DIFTERT
                                            BCS SETDELTAS ; IS IT < 12?
LDA #491 ; YES!!! BOPOTRON
STA ACTIVATE ; DIES PAINFULLY
                                                                                                                                                                                                                   CHECKS
                                                                                                                                                                                                                                                                                CHAR #8ET CHARACTER # ALLDONE # IF = # QUIT. FALLCOUNT # 18 FALLCOUNT FALLCOUNT # 1 OVER LIMIT? CHECK9 # NO. BRANCH.
SETDELTAS
                                                             #### ;CLEAR OUT OLD
DELTAX, ;DELTA VALUES.
DELTAY, ;
PNTR, X ;GET PNTR.
```

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# Circuit Database

32K Disk

#### by Randolph Constan

Being an electronics hobbyist, I have accumulated thousands of schematic diagrams over the years, for all kinds of circuits. A schematic, as you may already know, is a symbolic representation of an electronic circuit. If you're acquainted with them, you also know that they *always* end up on scraps of paper which mysteriously slip into the fourth dimension as soon as you try to locate one. "Where's that diagram you promised me for the video output board for my Atari 400?" asks my friend Jim impatiently. "I'm sorry, buddy," I say in an embarrassed tone, "I just can't seem to find it *anywhere*."

Well, if this sounds all too familiar, boot up your Atari and get ready to kiss this problem good-bye forever. Circuit Database will allow you to easily edit, save and retrieve up to sixty-one circuit diagrams, complete with all the necessary symbols and explanatory text, on a single side of a normal density disk. In fact, at only eight sectors per screen, sixty-nine screens could be saved, if DOS 2.0S allowed a bigger directory.

Typing it in.

First, prepare a newly-formatted disk with DOS.SYS. As DUP.SYS is not needed, it can be deleted if you wish. Type in Listing 2 and save it on another disk. RUN it with your new disk inserted, and a special file called D:CIRCHAR.SYS will be created. This file will be used by Circuit Database to load the electronic symbol character set, along with a few machine language routines to increase program efficiency. A checksum value will warn you of an error, except in the unlikely event that two or more errors cancel each other out.

When the file has been successfully created and a copy of Listing 2 has been saved, reboot your Atari or type NEW, press RETURN and begin typing in Listing 1. When you have finished, make sure a copy is saved before typing RUN. Also, the program should be saved on your newly-prepared disk, with the filename D:CIRCUIT.SYS.

The reason for the .SYS extensions will be explained later. My apologies for the long list of data statements

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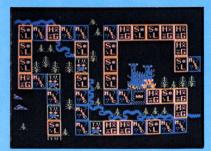
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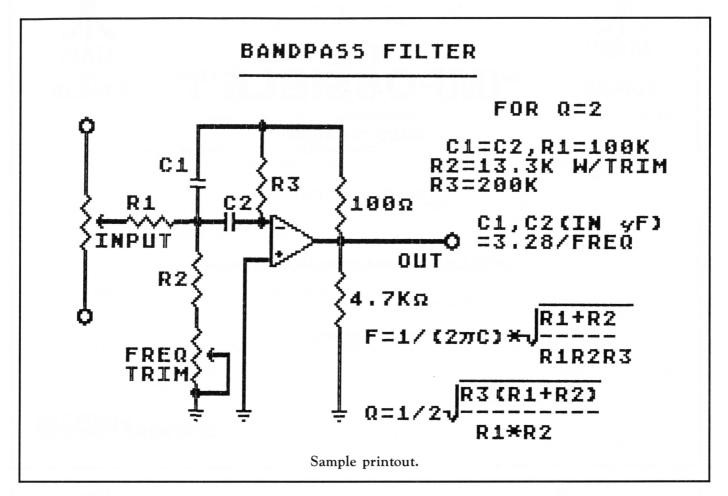
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in Listing 2. The character set is heavily edited and so, unfortunately, requires a full 1024 bytes, plus an additional 169 bytes for machine language routines.

#### About the program.

The obvious advantage of having the main program load in character set and machine language data from a separate file is speed. I hate long initializations and have found this method far superior to waiting for data to be POKEd into memory. This method, together with the CIO fast SAVE/LOAD routines from ANA-LOG Computing issue 13, allow Circuit Database to fully initialize within five seconds of typing RUN. A side benefit of this method is a significant savings in memory.

If you have finished typing in Listing 1 and have it saved as described above, RUN it. After a short initialization, a menu will appear with three choices. For now, select option 1. *Do not* press RETURN! The program will ask you for a filename. Right now, we are only interested in gaining familiarity with the editor, so just hit RETURN and plug a joystick into port 1. As you move the joystick, the program will begin to draw "wires" on the screen.

Notice that this is a graphics 0 screen, and yet—no matter how you turn, intersect or cross over existing wires—the display looks correct. The screen editor uses a method similar to bit-mapping for drawing these "wires" on the screen. Each time you move the

joystick, these mapping routines examine the present cursor location, the characters already above, below and on each side of your present location, and the direction in which you pushed the joystick. This data is compiled into a string variable called TEMP\$. Another string variable, WIRE\$, is then searched by a fast machine language routine, to "look up" the character which corresponds to the data stored in TEMP\$. That character is then printed on the screen. As a result, the drawing action seems a bit more like drawing on a graphics 7 screen than the graphics 0 screen that it actually is. If you notice any inconsistencies in this drawing action, carefully check the characters in Line 15175. This is the actual "look-up table" for the action described above. All circuit drawing is done with the joystick and one-key commands.

#### Command summary.

When the initial menu appears after first RUNning the program, three options are given. Later, when returning to the menu after viewing or creating a ciruit, a fourth choice will be given. These choices are:

1. DRAW NEW CIRCUIT — Allows entry of a filename, then proceeds to the editor screen. You must enter a valid filename if you wish your finished screen to be saved. *Do not* use the *D*: prefix!



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- 2. VIEW A PREVIOUS CIRCUIT Allows filename entry and displays selected circuit on the screen. After displaying the circuit, press an M to return to the menu, or hit P to print the screen on a graphics-compatible Epson or Gemini printer.
- 3. DISK CIRCUIT DIRECTORY Will display all files on the disk without a .SYS extension. In this way, no space is wasted displaying DOS.SYS or the program files. Up to thirty-nine files can be displayed simultaneously, and, if there are more, you'll be prompted before the directory listing continues. Also, the number of screens you can store with the remaining disk space is calculated and displayed at the bottom of the screen. But note that DOS allows a maximum of sixty-four files.
- 4. RETURN TO PRESENT CIRCUIT FOR EDITING This choice is displayed only when a circuit has already been loaded in or has been freshly drawn.

#### Screen editor commands.

The following is a descriptive listing of all the joystick and keyboard functions available while in the DRAW/EDIT mode (menu items 1 and 4). These functions have many subtle features. Experiment for a while, and you'll find no end to the number of symbols you can create by combining commands with careful editing.

JOYSTICK — Use for drawing wires. These wires automatically join or cross over other wires as you move about the screen. To move without drawing, hold the joystick button down as you move.

E (ERASE MODE) — The cursor can now be moved as an eraser. Push the joystick button to return to normal edit (you *must* return to normal edit to execute other commands).

H (HELP SCREEN) — Displays a summarized listing of all editing commands. Press any key to return to your drawing.

The following commands will only function when the last joystick command was a move to the right and when adequate space is available between the cursor and screen borders:

Q (TRANSISTOR) — Hit Q up to six times in succession to get the symbol you want. Two bipolar, two FETS and two unijunction types are given. Hit any key to return.

A (OP-AMP) — Operational amplifier.

I (I.C. GATE) — Hit *I* up to four times for the most appropriate symbol. Press any key to return.

G (GROUND) — For this, the last joystick command must be a downward move.

The following commands will work regardless of joystick direction, provided enough space is available.

Otherwise, the "component" will not be drawn—or, in some cases, will be shortened.

R — Resistor.

C — Capacitor.

D — Diode. Polarity will depend on last joystick directional command.

S — Switch.

L — Loop (coil, inductor).

T — Termination point.

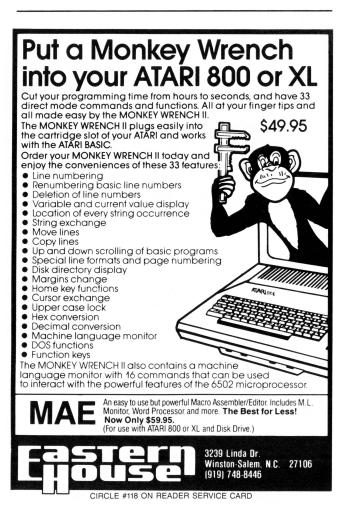
ARROW KEYS — Draw arrow chosen. Useful in creating potentiometers and other variable devices.

The following commands are executed while holding down the CONTROL key:

CTRL-P — Print screen. This command will print the circuit display on a Gemini or an Opson printer with the Graftrax graphics option. This process takes several minutes. The cursor will stop flashing during the printing process. When complete, the cursor will resume flashing, and you can continue editing the circuit.

CTRL-S — Solder. Use to solder two completely crossed wires. Position cursor over the crossed pair and push CTRL-S. It will then be necessary

(continued on next page)



to hold the joystick button down when moving away, or the "unconnected" default character will re-appear.

CTRL-CLEAR — Clears screen. Caution: picture cannot be recovered.

CTRL-ARROW keys — Scrolls screen in chosen direction. Erasing will occur at screen edges!

CTRL-C — Color change. Changes the background, text and border colors. Many combinations are possible.

CTRL-T — Text mode (see below).

#### Text mode.

After entering text mode, you can use the CTRL-ARROW keys to move the cursor anywhere on the screen. You can then enter text containing alphabetic and numeric characters. The space bar, backspace and CTRL-ARROWs are the only active editing keys. Also, the following special symbols are available:

CTRL-P - Pi.

CTRL-O — Ohms symbol.

CTRL-M — Micro symbol.

CTRL-S — Square root symbol.

When you have finished entering text, press the ESCape key, and the following options will be displayed on a "mini-menu."

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Dept. 2 P.O. Box 605 Stanton, CA 90680 name has been entered. Otherwise, you will be returned to the mini-menu. E (EDIT) — Return to circuit screen editor and

S (SAVE) — Saves screen to disk if a valid file-

joystick control.

M (MENU) — Brings you back to the main menu. Option 4 will now be available if you wish to return to editing.

#### A few final notes.

The BREAK key has not been disabled, to permit easy code modification and debugging. If you accidently hit BREAK, GOTO Line 1000 to safely reenter the program. Also, if you hit SYSTEM RESET, you will have to re-RUN.

Avoid the CAPS/LOWER key, since only capital letters are accepted for input throughout the Circuit Database program.

Oh, and one final point: resist the temptation to remove the REM statements to save yourself typing, as I GOTO and GOSUB them frequently. The day will come when you will want to add a few customized commands to the screen editor. If you venture to print out the entire modified character set, you will see many possibilities which have not yet been implemented. However, the program flow is fairly complex, and these REM statements will prove to be an invaluable aid, should you want to make any additions.  $\square$ 

#### Listing 1.

```
10 REM CHARACTER SET FILEMAKER FOR
20 REM CIRCUIT DATABASE
30 OPEN #1,8,0,"D:CIRCHAR.SY5"
35 B=0:FOR I=1_TO 1024:READ A
  40 PUT #1,A:B=B+A
 50 NEXT
50 NEXT I
60 IF B(>66693 THEN ? "ERROR IN CHARAC
TER DATA STATEMENTS":STOP
70 ? "CHARACTER SET FILE COMPLETE"
75 B=0:FOR I=1 TO 169:READ A
80 PUT #1,A:B=B+A
 85 NEXT I
90 IF B<>24752 THEN ? "ERROR IN MACHIN
 E LANGUAGE DATA": STOP
 95 CLOSE #1
96 ? "MACHINE CODE FILE COMPLETE"
79 END
100 DATA 0,0,0,0,0,0,0,0,0,24,24,24,24
,0,24,0,0,102,102,102
102 DATA 0,0,0,0,0,102,255,102,102,255
,102,0,24,62,96,60,6,124,24,0
104 DATA 0,102,108,24,48,102,70,0,0,0
0,51,102,60,12,24,0,24,24,24
106 DATA 0,0,0,0,14,28,24,24,24,8
112,56,24,24,56,112,0
108 DATA 0,102,60,255,60,102,0,0,0,24,24,126,24,24,00,0,0,0
110 DATA 0,24,24,48,0,0,0,126,0,0,0,0
110 DATA 0,24,24,48,0,0,0,126,0,0,0,0
111 DATA 0,6,12,24,48,96,64,0,0,60,102
112 DATA 0,6,12,24,48,96,64,0,0,60,102
113 DATA 0,6,12,24,48,96,64,0,0,60,102
114 DATA 24,24,126,0,0,60,102,12,24,48
,126,0,0,126,12,24,12,102,60,0
115 DATA 0,126,12,24,12,102,60,0
116 DATA 0,12,28,60,108,126,12,0,0,126,12,96,124,18
DATA 102,102,60,0,0,126,6,12,24,48
  99 END
 ,48,0,0,60,102,60,102,102,60,0
120 DATA 0,60,102,62,6,12,56,0,0,0,24,
24,0,24,24,0,0,0,24,24
```

140 DATA 0,124,102,102,124,108,102,0,0,60,96,60,6,66,60,0,0,126,24,24
142 DATA 24,24,24,0,0,102,102,102,102,102,
102,126,0,0,102,102,102,102,102,60,24,0
144 DATA 0,99,99,107,127,119,99,0,0,10
2,102,60,60,102,102,0,102,102,102,60
146 DATA 24,24,24,0,0,126,12,24,48,96,
126,0,0,30,24,24,24,24,30,0
148 DATA 3,3,3,243,51,55,30,12,0,120,2
4,24,24,120,0,0,8,28,54
150 DATA 99,0,0,0,0,0,0,0,0,0,255,0,0,0,255,54,54,102,204,0
152 DATA 24,24,60,127,127,60,24,24,3,3,3,3,3,3,3,3,24,24,24,24
156 DATA 248,0,0,0,24,24,60,254,254,60
124,24,0,0,0,248,248,24,24,24
156 DATA 255,192,192,192,192,192,255,192,192,192,255,192,192,192,255,192,192,192,255,192,192,192,248
14,7,3 55,192,192,192,255,255,192,192,192,248
,14,7,3
158 DATA 3,7,14,248,0,0,112,223,223,11
2,0,0,24,24,31,0,0,31,24,24
160 DATA 24,31,0,255,255,0,31,24,24,12
6,231,195,195,231,126,24,255,255,0,0
162 DATA 0,0,0,0,0,0,0,0,0,0,255,255,0,126,126,126,126,126,126,126,126,0
164 DATA 3,3,3,255,255,3,3,3,0,0,0,31,31,24,24,24,24,0,0,0,255
166 DATA 255,0,0,0,24,24,24,219,255,24,24,24,3,51,27,255,255,27,51,3
168 DATA 3,51,99,255,255,27,51,3
168 DATA 3,51,99,255,255,99,51,3,192,1
92,192,192,192,192,192,0,24,60,255,255
170 DATA 255,60,24,24,24,24,24,60,255,255
170 DATA 24,24,24,24,24,24,24,24,24
172 DATA 24,24,24,24,24,24,24,24,24
172 DATA 24,24,24,24,24,24,24,24,24,24
174 DATA 24,24,24,24,24,24,24,24,24,24,24
175 DATA 0,24,48,127,127,48,24,0
176 DATA 0,24,12,254,254,12,24,0,24,24
178 DATA 141,7,2,0,24,12,6,12,24,48,96
178 DATA 141,7,2,0,24,12,6,12,24,48,96
178 DATA 24,24,231,231,102,102,102
180 DATA 24,24,255,0,0,255,24,24,198,2
30,246,255,255,256,246,230,198,99,103,111,255
182 DATA 255,111,103,99,255,24,60,126. 255 182 DATA 255,111,103,99,255,24,60,126, 255,24,24,24,24,24,255,126,60,24,25 184 DATA 0,3,6,252,252,0,0,0,0,231,60, 102,102,102,102,60,0,192,96,63 186 DATA 31,0,0,0,24,24,24,24,24,28,6, 3,3,3,118,204,204,118,3,3 188 DATA 3,6,28,24,24,24,24,24,0,240,2 20,199,193,192,223,192,0,0,0,0 190 DATA 192,112,28,7,192,112,28,7,7,2 8,112,192,204,222,204,193,199,220,240, 192 DATA 7,28,112,192,0,0,0,0,6,6,6,25 5,254,6,6,6,6,6,0,0 194 DATA 0,0,0,0,0,0,0,0,0,0,6,6,48,96 04,104,133,205,160,4,177,203,197,205,2 40,9,152

310 DATA 24,105,5,168,192,84,208,241,2
80,132,212,169,0,133,213,96
400 DATA 104,104,133,204,104,133,203,1
84,133,206,104,133,205,169,0,133,208,1
60,0,162
410 DATA 0,177,203,133,207,177,205,197
,207,208,1,232,200,192,4,208,240,224,4
,240
420 DATA 30,230,208,165,208,201,16,201
,17,240,20,165,203,24,105,5,133,203,16
5,204
430 DATA 105,0,133,204,160,0,162,0,24,144,206,177,203,133,212,169,0,133,213,96
500 DATA 104,104,133,207,104,170,104,1
33,206,104,133,205,104,133,204,104,133,203,160,0
510 DATA 177,203,145,205,202,208,6,165,207,240,17,198,207,230,203,208,2,230,204,234,234,234,234,234,96

#### CHECKSUM DATA.

(see page 90)

10 DATA 10,278,930,599,155,380,504,805,849,163,401,799,523,515,286,7197
100 DATA 969,124,763,345,308,841,843,982,962,949,183,219,664,511,708,9371
130 DATA 85,893,417,551,684,974,656,427,653,814,11,613,147,621,619,8165
160 DATA 656,794,15,33,173,532,5,295,187,786,458,0,954,646,5,5539
190 DATA 919,20,299,248,103,957,499,682,741,637,204,394,82,693,494,6972

#### Listing 2.

10 REM CIRCUIT COMPILER AND EDITOR 11 REM BY R.CONSTAN, 1984 12 REM ANALOG COMPUTING 13 REM 15 GOSUB 15000 20 GRAPHICS C18:POSITION C7,C3:? #C6;"
SYSTEM INITIALIZATION":POSITI ON C1,C8:? #C6;"ONE MOMENT PLEASE"
30 GOSUB 15100:GRAPHIC5 C0 48 GOTO 1000:REM JUMP TO MENU. 50 REM JOYSTICK/COMMAND SUBROUTINE 51 IF PEEK(764) <> C255 AND NOT ERASE T HEN GOTO 2000:REM ESCAPE SEQUENCE 52 POKE 764,C255 54 DRAM=STRIG(C0):IF ERASE AND N NOT ST RIG(CO) THEN ERASE=CO
55 TRAP 51:S=STICK(CO):GOTO S+50
57 LET COMMAND=C4:XNOW=XNOW+(XNOW/C38) : RETURN COMMAND=C3:XNOW=XNOW-(XNOW)C0): 61 LET RETURN 63 LET COMMAND=C2:YNOW=YNOW+(YNOW(C22) : RETURN 64 LET COMMAND=C1:YNOW=YNOW-(YNOW)C1): RETURN 65 POKE 755, ( NOT PEEK (755))\*C2:50UND C1,75,C10-ERASE\*C2,PEEK(755)\*C1:GOTO 5 66 REM GUARDED AREA:ADD NO LINES ABOVE 100 REM CIRCUIT EDITOR INITIALIZATION 110 GRAPHICS CO 115 GOSUB 15140:REM CHECK ML ADDRESSES 120 SETCOLOR C2,C3,C4:SETCOLOR C4,C3,C 4:POKE 82,C0 122 DRAW=C1:ERASE=C0 140 X=C20:Y=C12:XNOW=X:YNOW=Y

```
320 GOSUB 50:POKE 755.C2:SOUND C1,56,C
10-ERASE*C2,C2:REM GET COMMAND
325 IF ERASE OR NOT DRAW THEN DELAY=S
325 IF ERASE OR NOT DRAW THEN DELICT-
IN(C2):GOTO 475
329 REM CHECK PRESENT POS. AND PREVENT
OVERWRITE OF NON-LINE CHRS.
330 LOCATE XNOW, YNOW, A:POSITION X, Y:IF
A<>32 AND A<>160 THEN A=USR(SEARCH, WI
RE, A):IF A=85 THEN 320
360 TRAP 380:LOCATE X+C1, Y, A:K$=CHR$(A
3:REM RUGHU
364 A=USR(SEARCH, MIRE, A)
368 TEMP$(C1,C1)=MIRE$(A-C3)
 380 TRAP 400:LOCATE X-C1,Y,A:K$=CHR$(A
384 A=USR(SEARCH, MIRE, A)
388 TEMP$(C2,C2)=MIRE$(A-C4)
400 TRAP 420:LOCATE X,Y+C1,A:K$=CHR$(A)
1:REM B3UOI
404 A=USR(SEARCH, MIRE, A)
408 TEMP$(C3,C3)=MIRE$(A-C1)
420 TRAP 440:LOCATE X,Y-C1,A:K$=CHR$(A)
1:REM ABOUI
424 A=USR(SEARCH, MIRE, A)
428 TEMP$(C4,C4)=MIRE$(A-C2)
429 TRAP 440:LOCATE X,Y-C1,A:K$=CHR$(A)
1:REM ABOUI
421 TEMP$(C4,C4)=MIRE$(A-C2)
432 TEMP$(C4,C4)=MIRE$(A-C2)
433 TEMP$(C4,C4)=MIRE$(A-C2)
444 POKE 755,C0:POKE 82,X:PUT #6,155:R
441 SOUND C1,C0,C0,C0
442 TEMP$(C5-COMMAND,C5-COMMAND)="\forallo":REM GURRENT COMMAND
445 LOCATE X,Y,A:POSITION X,Y:IF A=C32
OR A=160 THEN 450:REM GURRENT LOCATEO
 ):REM (13)
 446 B=USR(SEARCH, WIRE, A):IF B=85 THEN
449 NEXT I
450 REM NOW FIND CORRECT CHR MATCH!
455 A=USR(CSEARCH, WIRE, ADR(TEMP$))
 472 GOTO 489
475 IF NOT
475 IF NOT DRAW THEN POKE 82,C0:SOUND C1,C0,C0,C0:GOTO 490 476 IF ERASE THEN A=C32 480 POSITION X,Y:? "\",'CHR\(A);"\",'PO
KE 82,C0
490 X=XNOW:Y=YNOW:POSITION X,Y:? "→←";
 499 REM XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 500 REM COMPONENT DRAW UTILITY ROUTINE
 510 FOR I=C1 TO N
520 IF (COMMAND=C1) AND ((YNOW(C3) OR (I=N)) THEN K$="|":I=N:GOTO 549
 522 IF (COMMAND=C2) AND ((YNOW)C20) OR (I=N)) THEN K$="|":I=N:GOTO 540
(I=N)) THEN K$="|":I=N:GOTO 540
530 IF (COMMAND=C3) AND (CXNOW(C2) OR
(I=N)) THEN K$="-":I=N
532 IF (COMMAND=C4) AND (CXNOW)C36) OR
(I=N)) THEN K$="-":I=N
540 POSITION XNOW, YNOW:? K$:GOSUB L (CO
MMAND):NEXT I
550 POSITION XNOW, YNOW:? " 4";:X=XNOW:
 HONY=Y
 560 GOTO 52
595 X=XNOM:Y=YNOW:GOTO 52
```

```
options
  1040 POSITION CO.C3:? "
 1050 FOR I=C4 TO C18:POSITION C0,I:?"
";:POSITION C39,I:?"
1060 POSITION C0,I:?"
 1070 POSITION C0,C6:? "
 DRAW NEW CIRCUIT":?
1075 ? " 2-----
                                                     -----VIEW PREVIOUS C
 IRCUIT":?
 1080 ? " 3-----DISK CIRCUIT DIRECTORY":?
1090 IF DRAW THEN ? " 4-----RETURN TO PRESENT >>> CIRCUIT FOR EDITING"
1291 !?
 1095 ? " *** ENTER SELECTION **
*":POSITION C0,C0:? ">*";
1100_GET_#C2,MENU:IF MENU>C128 THEN PO
KE 764,C39
1110 IF (MENU\49) OR (MENU\52-( NOT DR
AM)) THEN SOUND C1,C256-C1,C10,C10:DEL
AY=C2^C2:SOUND C1,C0,C0;G0T0 1100
 1120 MENU=MENU-48:IF MENU>C2 THEN 1300
1125 FILE$="D:"
 1130 POSITION C4,C21:? "ENTER CIRCUIT
NAME: [ ]";:POSITION 25,21:
     11 411
 1132 FOR I=C1 TO C13
1135 GET #C2,B:IF B=155 THEN 1170
1136 IF (I=C13) AND (B<>155) THEN 1135
1138 IF B>C128 THEN POKE 764,C39:GOTO
 1135
1135

1140 IF (B=126) AND (I>C1) THEN ? "+ + ";;I=I-C1;FILE$(I+C2)="":GOTO 1135

1145 IF (B=46) OR ((B>47) AND (B<58))

OR ((B>64) AND (B<91)) THEN FILE$(I+C2,I+C2)=CHR$(B):GOTO 1160

1150 SOUND C1,C256-C1,C10,C10;DELAY=SIN(C2):SOUND C1,C0,C0,C0;GOTO 1135

1160 POSITION 24+I,C21;? CHR$(B);:NEXT
 1170 IF MENU=C1 THEN 100
1180 TRAP 1250:CLOSE #C1:OPEN #C1,4,C0
,FILE$:GRAPHICS C0:POKE 709,C0:POKE 71
 0,C0:POKE 712,C0:GOSUB 15140
1200 ADDRESS=SCREEN:NUMBER=C960+C10:IO
 =C1:G05UB 6200:NUMBER=NUMBER+SCREEN-C9
 :CLOSE #C1
:CLOSE #C1
1205 GOSUB 1650:B=USR(MOVE,C960+C10,AD
R(HOLD$),SCREEN)
1210 POSITION C2,C23:? "*** PRESS M FO
R MENU, P TO PRINT ****";:POSITION C0,C
0:? ">+<";:POKE SCREEN,C0
1220 DRAM=C1:GET #C2,A:IF A>C128 THEN
POKE 764,C39:A=A-C128
1230 IF A=77 THEN 1240
1232 IF A=80 THEN GOSUB 16000
1233 GOTO 1220
1233 GOTO 1220
1240 POSITION C0,C23:? BL$;:GOTO 1000
1250 POSITION C2,C21:? "MATILE NOT FO
UND CAN'T CCCESS DISK! ":FOR I=C1 TO C
10:POKE 755,C3:SOUND C1,I,C4,C10
1252 DELAY=SIN(C2):POKE 755,C2:DELAY=S
IN(C2):SOUND C1,C0,C0,C0:NEXT I
1255 POSITION C2,C21:? BL$:GOTO 1100
1300 IF MENU<>C4 THEN 1350
1301 REM RESTORE CIRCUIT
1305 POKE DL+C3,66:POKE DL+C6,C2:POKE
DL+C7,C2:POKE DL+C8,C2
```

```
1310 ? "K":B=USR(MOVE,970,SCREEN,ADR(HOLD$)):605UB 1650:GOTO 122
1350 POKE 752,C1:REM PIREGIORY
1355 GOSUB 1600
1360 POSITION C0,C0:? " +";
1370 TRAP 1380:CLOSE #C1:OPEN #C1,C6,C
0,"D:*.*":GOTO 1400
1380 POSITION C10,C7:? "GALLE AGGESSED
15KLO";:SOUND C1,C128,C12,C10:DELAY=C2
^C2^C2:SOUND C1,C0,C0,C0,C0
1390 FOR DELAY=C1 TO C10:NEXT DELAY:?
"5":POKE 752,C0:GOTO 1000
1400 TRAP 40000:FOR B=C1 TO C2:FOR I=C
1 TO 27 STEP C12:FOR J=C5 TO C17
1410 TRAP 1410:INPUT #C1,DIR$:IF DIR$(
C5)="FREE SECTOR5" THEN 1440
1415 IF DIR$(C11,C13)="5Y5" THEN 1410
1420 POSITION I,J:? BL$(C1,C12);:POSITION I,J:? DIR$(C2,C13);:NEXT J:NEXT I
1430 POSITION C5,C20:? "CONTINUE (Y,N)
? ";:GET #C2,A:IF A=78 THEN 1000
1435 POSITION C0,C20:? "DISK SPACE ="
  1370 TRAP 1380:CLOSE #C1:OPEN #C1,C6,C
 0,C0:? " 
'':NEXT B
1440 POSITION C0,C20:? "DISK SPACE ="
;INT(VAL(DIR$(C1,C3))/C8);" SCREENS.":
? "PRESS ANY KEY FOR MENU";
1450 CLOSE #C1:GET #C2,A:IF (A>C128) A
ND (A\{\}155) THEN POKE 764,C39
1455 ? "M":POKE 752,C0:GOTO 1000
1599 STOP
1600 REM GUEAR FINDOX
1610 COLOR 160:FOR I=C5 TO C18:PLOT C1
,I:DRAMTO C38,I
1620 SOUND C1.I.C10.C10:POSITION C1.I:
  1620 SOUND C1,I,C10,C10:POSITION C1,I:
? #6;BL$(C1,C38);:NEXT I:? #6:SOUND C1
,C0,C0,C0:RETURN
 1640 FOR I=C1 TO C9:POKE SCREEN+C960+I
,PEEK(703+I):NEXT I:RETURN :REM SAVE C
OLORS
  1650 FOR I=C1 TO C9:POKE 703+I,PEEK(SC
REEN+C960+I):NEXT I:RETURN :REM RESIOR
 E COLORS
2000 REM LINES 2008 TO 4200 RESERVED
2001 REM LINKUP AREA
2002 REM DONT FORGET POP IF EXITY
2010 IF PEEK(764)=C39 THEN POKE 764,C3
 2010 IF PEEK (764)=C39 THEN POKE 764, C3
9:GOTO 52:REM INUERSE
2015 LINK=500
2020 TRAP 52:GET #C2, LINE:POKE 755, C0:
LINE=LINE*C8+2100:GOTO LINE
2124 REM (CHR) WCWEKOLOR GHANGE
2125 A=PEEK (710):A=A+C16:POKE 710, (A<C
256)*A+(A>=C256)*(A-C256)
2126 IF A>C256 THEN A=PEEK (709):POKE 7
09, PEEK (710):POKE 710, A
2127 A=PEEK (712):A=A+16:POKE 712, (A<C
256)*A+(A>=C256)*(A-255)
2128 GOTO 52
 2128 GOTO 52

2228 REM (CTRL) PEEPSON SCREEN PRINT

2229 GOSUB 16000:GOTO 52

2252 REM (CTRL) SESOLDER

2253 LOCATE X,Y,A:IF A=C19 OR A=147 TH

EN POSITION X,Y:? " +";
  2254 GOTO 52
2260 GOTO 5000:REM (CTRL) WTW=TEXT MODE
2324 POSITION CO,CO:? "T";BL$;:IF Y>C1
       THEN Y=Y-C1
 THEN Y=Y-C1
2325 YNOW=Y:POSITION X,Y:? ">←";:GOTO
52:REM SCROUT UP
2332 POSITION C0,C0:? "U":POSITION C0,
C23:? BL$;:IF Y C22 THEN Y=Y+C1
2333 YNOW=Y:POSITION X,Y:? "→←";:GOTO
52:REM SCROUT DOWN
2340 FOR I=C1 TO C22:POSITION C0,I:? "
U":SOUND C1,I,C8,C2:NEXT I:IF X>C0 THEN X=X-C1
  EN X=X-C1
 2341 XNOW=X:POSITION X,Y:? "→+";:GOTO
52:REM SGROUN UEST:
2348 FOR I=C1 TO C22:POSITION C38,I:?
"";:POSITION C0,I:? "":5OUND C1,I,C8
,C2:NEXT I:IF X C38 THEN X=X+C1
```

TO LINK 2638 K\$="c":GOTO LINK 2644 REM <u>DIODE DRAN</u> 2645 N=C2:IF COMMAND=C1 THEN K\$="g":GO TO LINK 2646 IF COMMAND=C2 THEN K\$="h":GOTO LI MK 2647 IF COMMAND=C3 THEN K\$="f":GOTO LI NK 2648 IF COMMAND=C4 THEN K\$="e":GOTO LI 2652 ERASE=C1:GOTO 52 2668 REM GROUND DRAF 2669 IF COMMAND=C2 THEN ? "++";:GOTO 5 2670 GOTO 52 2676 REM <u>HELP SCREEN</u> 2677 POSITION C0,C0:? "→←";:POKE SCREE N,C0:B=USR(MOVE,C960,ADR(HOLD\$),SCREEN 2678 ? "K":GOSUB 4500:B=USR(MOVE,C960, SCREEN,ADR(HOLD\$)):POSITION X,Y:? "→←" ;:GOTO 52\_\_\_\_\_\_ 2684 REM **IESCUGATE** 2685 IF (COMMAND⟨)c4) OR (XNOM)c34) OR (YNOW>C20) THEN 52 2686 B=C0 2687 SOUND C1,C36+C5\*B,C10,C4:DELAY=C2 ^C2:SOUND C1,C0,C0,C0:B=B+C1:IF B=C5 T HEN B=C1 2688 POSITION X,Y:GOTO 600+B 2708 REM **LECOTO (100)** 2709 IF COMMAND=C1 AND YNOW>C5 THEN ? "nf=nf=nf=1f=(1+f=";:YNOW=YNOW-C5:Y=YNOW :60TO 52 2710 IF COMMAND=C2 AND YNOW<C18 THEN ? "14+m4+m4+n4+(4+";:YNOM=YNOW+C5:Y=YNO W:GOTO 52 2711 IF COMMAND=C3 AND XNON>C5 THEN ? "kffjffjffjffiff=ff";:XNOW=XNOW-C6:X=X NOW:GOTO 52 2712 IF COMMAND=C4 AND XNOW(C33 THEN ? "ijjk=";:XNOW=XNOW+C6:X=XNOW:GOTO 52 2748 REM (REMANDS) C4) OR (XNOW)C37) OR (YNOW(C3) OR (YNOW)C37) OR (YNOW)C3) OR (YNOW)C3) OR (YNOW)C3) 2750 B=C0 2751 SOUND C1,C36+C5\*B,C10,C4:DELAY=C2 ^C2:50UND C1,C0,C0,C0:B=B+C1:IF B=C7 T HEN B=C1 2752 POSITION X,Y;GOTO 580+B 2756 REM <u>RESISTOR</u> 2757 N=C4:IF COMMAND<C3 THEN K\$="b":GO TO LINK 2758 K\$="a":GOTO LINK 2764 REM **SESTIMOT** 2765 N=C2:IF COMMAND<\$ THEN K\$="4":GO 2765 N=CZ:IF CUMMAND(C3 INEN K3=-7.00 TO LINK
2766 K\$="z":GOTO LINK
2772 REM (T=XT)(XAPTO)
2773 ? "" \";:GOTO 52
3100 ? "K":POSITION X,Y:? ">\\*";:GOTO 5 2:REM GLEAR SCREEN 4200 REM END OF RESERVED AREA! 4500 POKE 755,C2:POKE 752,C1:SOUND C1, C0,C0,C0 4502 ? "5 UMMARY)}\_ CIRCUIT DRAWING COMMAND 5 4505 ? "ဩ —aa—Þ@ —c→▶@ ijjk № —z→▶@ —e 4510 ? "[] --- }[ ♦}E+E+E+E+ --DRAW ARRO W5":? 4515 ? "ONE DIRECTION (€+) ONLY:" 4520 ? " ■ Ma. (4 TYPE5) -0P 4521 ? "@ 4522 ? " q=":?

4522

?

-rs

@ tx

(6 TYPES

```
4548 ? "[CTRL] # = 'SOLDER' CROSSED MT
  RES"
  4550 ? "[CTRL] @ = COLOR CHANGE"
4552 ? "[CTRL] &+&+&+&+ = SCROLL SCREE
 4554 ? "[CTRL] GTEAN =CLEAR SCREEN"
4556 ? "[CTRL] U = ENTER TEXT MODE,[ES
C]= EXIT":?
4558 ? "G=ERASE--PUSH JOYSTICK BUTTON
 4558 ? "G=ÉRASE--PUSH JOYSTICK BUTTON
 TO EXIT"
4560 ? "I = HELP SCREEN":? :?
4660 ? "PRESS ANY KEY TO RETURN TO EDI
T":GET #C2,A:POKE 752,C0:? "5":RETURN
5000 TRAP 40000:REN HEXTENDED
5005 POKE 755,C2:SOUND C1,C0,C0,C0:POS
ITION C0,C0:? ">+";:POKE 5CREEN,C0:B=U
SR(MOVE,C960,ADR(HOLD$),SCREEN)
5010 IF PEEK(764)=C256-C1 THEN 5100
5015 GFT #C2.4
 5015 GET #C2,A

5016 IF A=C13 THEN POSITION X,Y:? "&";

:X=X+C1:GOTO 5050

5017 IF A=C15 THEN POSITION X,Y:? "@";

:X=X+C1:GOTO 5050
 5018 IF A=C16 THEN POSITION X.Y:? "#":
  :X=X+C1:GOTO 5050
 5019 IF (A=19) AND (X<C35) AND (Y>C0)
THEN POSITION X,Y:? "\++ | ++++";:X=X
+C1:GOTO 5050
 5020 IF ((A)C31) AND (A(96)) OR ((A)15
9) AND (A(224)) THEN POSITION X,Y:? CH
R$(A);:X=X+C1
5022 IF (A)155) AND (A(160) THEN POKE
 764,C39:A=A-C128
5025 IF (A)27) AND (A(32) THEN ? CHR$(
A);:GOTO 5000+A
A);;;6010 5050+H

5026 GOTO 5050

5028 Y=Y-(Y>C0):GOTO 5040

5029 Y=Y+(Y<C23):GOTO 5040

5030 X=X-(X>C0):GOTO 5040

5031 X=X+(X<C38):GOTO 5040
 5040 POSITION X,Y:? ">+";
5040 POSITION X,Y:? ">+";
5050 IF (A=126) OR (A=254) THEN X=X-(X
(>C0):POSITION X,Y:? " +";:IF A=254 TH
EN POKE 764,C39
5060 IF A=27 THEN GOTO 5200
5080 IF A=125 OR A=253 THEN B=USR(MOVE,960,SCREEN,ADR(HOLD$)):POSITION X,Y:?
 5090 IF X=C39 THEN X=C38:POSITION X,Y:
 $100 DÉLAY=DELAY+C1:IF DELAY>C4 THEM D
ELAY=C0:POKE 755,( NOT PEEK(755))*C2
ELAY=C0:POKE 755, ( NOT PEEK(755)]*CZ
5110 GOTO 5010
5200 POKE 755, C2
5210 POSITION C0, C0:? "'>←";:POKE SCREE
N, C0:GOSUB 1640:B=USR(MOVE, C960+C10, AD
R(HOLD$), SCREEN)
5220 POKE 752, C1:FOR I=C0 TO C8:POSITI
ON C10, I:? """";:SOU
ND C1, I*C4, C8, C4:NEXT I
5225 SOUND C1, C0, C0, C0
5230 POSITION C12, C1:? "ENTER COMMMNDT
5235 POSITION C16,C3:? "EEEDIT"
5240 POSITION C16,C4:? "SESAVE"
5250 POSITION C16,C5:? "MEMENU"
5260 POSITION C21,C7:? "*";:POSITION C
0,C0:? ">+";:POKE 5CREEN,C0:GET #C2,A:
IF A>C128 THEN A=A-C128:POKE 764,C39
5270 IF (A=69) OR (A=83) OR (A=77) THE
5235 POSITION C16, C3:? 5240 POSITION C16, C4:?
 N 5300
N 5388

5288 SOUND C1,200,C10,C10:DELAY=C2^C2:

50UND C1,C0,C0,C0:GOTO 5268

5300 GOSUB 1640:B=USR(MOVE,C960+C10,SC

REEN,ADR(HOLD$))

5310 IF A=69 THEN POKE 752,C0:XNOM=X:Y

NOM=Y:POSITION X,Y:? " +";:GOTO 52

5320 IF A=77 THEN POKE 752,C0:POP :GOT
    1000
5330 GOSUB 1640:TRAP 5400:CLOSE #C1:OP
EN #C1,C8,C0,FILE$
5340_NUMBER=C960+C10:ADDRESS=SCREEN:IO
 =C1:605UB 6000
 5350 POSITION C10,C7:? "K ** SAVE COMP
 5360 DELAY=C2^C2^C2:6070 5220
```

5400 SOUND C1.C256-C1.C10.C10:POSITION C10,C7:? "CAN'T ACCESS DISKED"; 5410 DELAY=C2^C2:SOUND C1,C0,C0,C0:FOR DELAY=C1 TO C16:NEXT DELAY:GOTO 5220 6000 REM CTO TO PUT BYTES IO=C16\*IO
IOCB=832+IO:POKE IOCB+C2,C11
ADRHI=INT(ADDRE55/256)
ADRLO=ADDRE55-C256\*ADRHI 6010 6920 6030 6848 6050 POKE IOCB+C4,ADRLO:POKE IOCB+C5,A DRHI NUMHI=INT(NUMBER/256) NUMLO=NUMBER-C256\*NUMHI POKE IOCB+C8,NUMLO:POKE IOCB+C9,N 6868 6979 6888 UMHI 6090 I=USR(ADR("hhh뜵LV탭"),IO) 6100 CLOSE #IO/C16 RETURN
REM OIO TO GET BYTES
10=C16\*I0
10CB=832+I0:POKE 10CB+C2,C7 6110 6200 6210 6220 ADRHI=INT (ADDRESS/C256) ADRLO=ADDRESS-ADRHI\*C256 6230 6248 POKE IOCB+C4,ADRLO:POKE IOCB+C5,A 6250 DRHI NUMHI=INT(NUMBER/C256) NUMLO=NUMBER-C256\*NUMHI POKE IOCB+C8,NUMLO:POKE IOCB+C9,N 6260 6270 6280 UMHI 6290 I=USR(ADR("hhhalve"), 10)
6298 RETURN
15000 REM PROGRAM INITIALIZATION
15040 REM SET UP CONSTANTS
15050 C0=0:C1=1:C2=C1+C1:C3=C2+C1:C4=C
3+C1:C5=C4+C1:C6=C5+C1:C7=C6+C1:C8=C7+
C1:C9=C8+C1:C10=C9+C1:C11=C10+C1
15055 C12=C11+C1:C13=C6+C7:C14=C7+C7:C
15=C7+C8:C16=C8+C8:C17=C9+C8:C18=C9+C9:C19=C10+C9:C20=C10+C10:C21=C20+C1
15060 C22=C21+C1:C23=C21+C2:C30=C23+C7 6290 I=USR (ADR ("hhhallva"), IO) 15060 C22=C21+C1:C23=C21+C2:C30=C23+C7:C31=C30+C1:C32=C30+C2:C33=C32+C1:C34=C33+C1:C35=C34+C1:C36=C35+C1 1C48=C37+C1:C1Z8=1Z8:CZ30=C1Z0+C1Z0:CZ 55=C256-C1:C960=960 15078 DIM L(C4):L(C0)=52:L(C1)=64:L(C2)=63:L(C3)=61:L(C4)=57:LET COMMAND=C0 15080 REM DIMENSION STRINGS 15085 DIN WIRE\$(85), TEMP\$(C4), K\$(C1), B L\$(C39), HOLD\$(980), FILE\$(C15), DIR\$(C30 15090 REM MOMERAMENTOR
15095 POKE 106, PEEK (106) - C8: GRAPHICS C
0: DRAW=C0: RETURN
15100 ADDRESS= (PEEK (106) + C4) \* C256: NUMB
ER=1024: IO=C1: OPEN #C1, C4, C0, "D: CIRCHA R.5Y5":G05UB 6200 15110 CHAR=ADDRESS/C256:REM OH SET LOG 15120 ADDRESS=1536:NUMBER=169:IO=C1:60 SUB 6200:CLOSE #C1:REM [NEW LOCATIONS] 15140 SEARCH=1536 15150 CSEARCH=SEARCH+C36 =BL\$:BL\$(C2)=BL\$
15200 5CREEN=PEEK(88)+C256\*PEEK(89)
15210 DL=PEEK(560)+C256\*PEEK(561)
15220 CLOSE #C2:OPEN #C2,4,C0,"K:"
15230 POKE 756,CHAR
15300 RETURN
16000 REM #FSON SCREEN FRITT
16010 P5C=PEEK(88)+PEEK(89)\*256:TRAP 1
6060;CLOSE #C5:OPEN #C5,C8,C0,"P:":? #C5;"#A";CHR\$(C8)
16020 FOR I=P5C TO P5C+39:? #C5;"#K";CHR\$(184);CHR\$(C0);
16030 FOR J=1+880 TO I STEP -C40:CSUB=C0:C52=C0:IF PEEK(J)>127 THEN CSUB=C12 8:C52=C255 16040 PCH=AB5(PEEK(J)-CSUB):CHLOC=PEEK (756)\*C256+PCH\*C8

16050 FOR J2=CHLOC+C7 TO CHLOC STEP -C 1:PUT #C5, AB5(C52-PEEK(J2)):NEXT J2:NE XT J:? #C5:NEXT I:? #5;"\{e":CLOSE #1 16060 TRAP 40000:RETURN

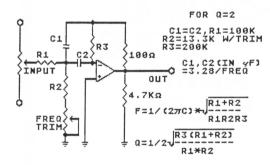
#### CHECKSUM DATA.

(see page 90)

(see page 90)

10 DATA 48,578,295,260,851,374,494,306,284,197,976,265,954,223,640,6745
61 DATA 408,615,416,277,414,807,147,55
1,507,755,199,967,816,177,19,7075
320 DATA 898,786,609,686,745,436,762,1
49,442,771,705,420,748,692,426,9275
428 DATA 757,779,808,172,499,260,322,2
90,755,547,850,742,366,56,842,8045
490 DATA 350,72,564,207,504,34,140,628,236,224,520,442,896,898,358,6073
584 DATA 362,842,848,571,924,1,587,561,592,566,544,905,787,359,75,8524
1020 DATA 316,503,804,338,843,28,877,862,966,88,225,149,845,953,506,8303
1132 DATA 369,80,197,87,963,524,439,25
2,99,661,446,931,911,48,860,6897
1232 DATA 564,717,746,59,846,424,87,30
0,505,227,331,956,199,762,475,7198
1390 DATA 142,697,220,653,425,564,825,234,946,702,621,135,829,239,381,7613
1650 DATA 634,504,939,727,307,916,163,985,371,489,171,648,703,63,232,7852
2253 DATA 811,646,767,203,319,614,157,922,148,666,519,388,383,373,396,7312
2620 DATA 425,157,878,908,895,801,452,893,599,596,596,825,786,972,652,10435

2676 DATA 690,730,870,769,171,269,306,956,639,913,471,18,430,211,636,8079
2750 DATA 257,300,959,988,898,802,592,943,849,853,236,994,938,602,91,10302
4505 DATA 75,951,930,198,947,382,911,288,856,61,858,420,776,812,996,8661
5005 DATA 130,308,908,753,59,91,31,899,278,300,962,740,467,263,445,6634
5031 DATA 249,298,924,361,215,605,241,722,180,448,954,829,117,657,711,7511
5250 DATA 697,599,900,798,856,289,335,816,117,137,836,693,782,297,747,8899
6010 DATA 814,204,696,902,621,491,102,758,696,378,793,710,820,24,960,8969
6240 DATA 887,627,7778,108,764,702,820,385,799,891,626,773,799,249,221,9429
15085 DATA 794,423,332,687,8,873,202,352,364,943,789,603,407,70,402,7249
15230 DATA 702,58,714,669,692,665,213,933,234,4880



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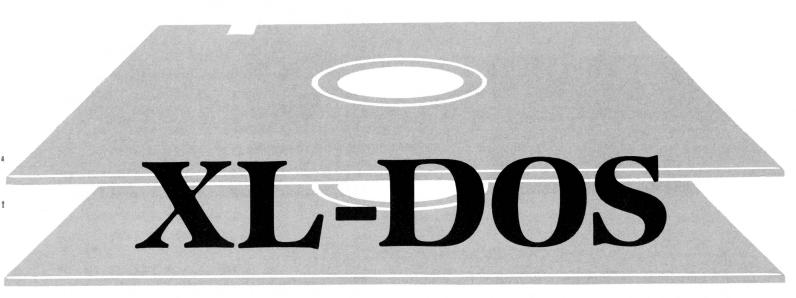
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16K Disk

#### by Robert Luce

XL-DOS is an end-user modification to Atari's DOS 2.0S for XL computers with 64K memory. It stores both DUP.SYS and the MEM.SAV file in the normally-unused top 16K of memory. Both DOS functions are rewritten to allow instantaneous loading of the DUP.SYS file from memory, with MEM.SAV always active.

Maybe I'm just impatient, but that long wait for DUP.SYS to load in has always bothered me. It's always right after I hit the RETURN key that I realize I've forgotten to save my BASIC program or assembler source code before using the DOS command. I know. . . using a MEM.SAV file would avoid this situation, but then it takes an incredible amount of time just to get the DOS menu. Yes, I'm still using DOS 2.0S. Most of my files use DOS 2, and, after looking at DOS 3, I think I'll wait for DOS 4 (now in the rumor stage).

If you use DOS 2, have an XL computer, and are as impatient as I am, I think you're going to love XL-DOS!

#### Working with XL-DOS.

If you think you might be interested in using **XL-DOS** but don't care how it works, I suggest you skip directly to the section on typing it in. For those of you who want to know more, read on...

As mentioned above, **XL-DOS** uses the top 16K in a 64K XL computer to store the DUP.SYS and MEM.SAV files, so there's *no waiting* for DUP.SYS to load into memory. After you type DOS RETURN, you are immediately presented with the DOS menu.

Not only that, but **XL-DOS** also handles the MEM. SAV function using this memory, so your program remains intact. Of course, some menu options, such as disk duplication, require use of the program area, but DOS 2 will ask your permission first, as usual when MEM.SAV is active.

When the disk is booted, you may notice that it's taking a bit longer than usual. This is because the DUP.SYS file must be read into memory. After it's in memory, the Operating System ROM is turned off, exposing the RAM underneath. The DUP.SYS file is then moved up to this hidden RAM and stored in the range from \$E400-\$F8FF. Because we are going to be switching back and forth between ROM and RAM at these addresses, the Atari character set data must also be copied to this RAM memory to avoid a very unsightly display. The area of memory used is \$E000-\$E3FF, the "normal" address of the character set data. All we do is copy from ROM to RAM at the same addresses. Finally, XL-DOS MEM.SAV routines use the RAM memory from \$C000-\$CFFF and from \$D800-\$DEFF. The range from \$D000-\$D7FF is always mapped to the hardware I/O, so it is unusable for our purposes.

#### Typing in XL-DOS.

First of all, you should have on hand a blank disk or a disk that can be formatted. Boot up your computer using DOS 2. If you have a 1200XL, make sure that the BASIC cartridge is installed. Next, type in the BASIC program and SAVE it to the disk before running it. There is an error-checking routine for the

data lines, so if you get the message *Error in data line* #..., check that line against the listing. Make your corrections, save it to disk, then run it again. When you have successfully created the "PATCH" file, you are ready to continue.

Go to the DOS menu by typing DOS and hitting RETURN. Make certain there is no MEM.SAV file on the disk. If there is, delete it. Next, type in L to load a binary file and press RETURN. The filename is "PATCH," so type in PATCH and hit RETURN. When it has loaded in, strike RETURN again to get the full menu displayed. If you look at the top line of the menu, you'll see that it has changed to version 2XL.

Now, remove the disk from drive 1 and put in a blank disk or one that can be erased. Using the "I" option from the menu, format the disk in drive 1, and then use the "H" option to write DOS files to the disk. This disk now contains a working copy of **XL-DOS**. Now, turn OFF the computer. *Do not* return to the cartridge or use any other functions. If you do, the machine will most assuredly lock up.

To use your new **XL-DOS**, simply reboot the computer using the disk you have just created. Type in a couple of lines of BASIC, then type DOS and hit RETURN. Fast, huh? Check out the disk directory. Nothing but DOS.SYS and DUP.SYS! Now, return to the cartridge and type *LIST*. Your BASIC program is still there!

#### A cautionary note.

XL-DOS doesn't use any more memory than DOS 2. It does, however, use the zero page addresses \$D4-\$D7 normally reserved for the floating point routines. Since XL-DOS uses these addresses when the floating point routines are not being used, there should be no incompatibility problems, unless a program is also using these zero page addresses. One example is the AtariWriter printer driver, which would not work with XL-DOS, but, since the AtariWriter never uses DUP.SYS or MEM.SAV, there is no reason to use XL-DOS with it, is there? Make sure to clearly mark this disk "XL-DOS." You may make additional copies simply by booting the XL-DOS disk and using the "H. Write DOS files" option. □

#### Listing 1. BASIC listing.

```
100 GRAPHICS 0:POSITION 13,1:? "XL-DOS CREATOR"
110 ? :? "NOW CHECKING YOUR DATA LINES
120 DIM F$(308)
130 LINCT=0:DONE=0
140 FOR X=1 TO 8:READ DATA
150 LINCT=LINCT+DATA
150 IF DATA=256 THEN POP :DONE=1:GOTO
190
170 F$(LEN(F$)+1)=CHR$(DATA)
180 NEXT X
190 READ CKSUM:CLINE=PEEK(183)+256*PEE
K(184)
200 LINCT=LINCT+CLINE
```

```
210 IF LINCT(>CKSUM THEN 280
220 ? "LINE #";CLINE;" IS OK!"
230 IF NOT DONE THEN 130
230 IF
      "DATA ALL OK - CREATING PATCH FI
240
250 TRAP 290:OPEN #1,8,0,"D:PATCH"
260 TRAP 40000:FOR X=1 TO 308:PUT #1,A
5C(F$(X,X)):NEXT X
270 CLOSE #1:? "PATCH FILE CREATED":EN
280 ? "ERROR IN DATA LINE #";CLINE:END
290 ? "ERROR IN OPENING PATCH FILE":?
"DISK_MAY BE_WRITE_PROTECTED.":END
1000 DATA 255,255,122,21,124,21,76,192
2066
1010 DATA 23,70,23,137,23,32,85,24,142
1020 DATA 169,0,133,212,133,214,169,29
1030 DATA 133,215,169,192,133,213,162,
16,2263
1040 DATA 32,119,24,169,216,133,213,16
2,2108
1050 DATA 7,32,119,24,32,70,24,96,1454
1060 DATA 169,0,133,212,169,224,133,21
1070 DATA 160,0,162,3,177,212,72,32,18
1080 DATA 85,24,104,145,212,32,70,24,1
1090 DATA 200,208,241,230,213,202,16,2
36,2636
1100 DATA 96,182,23,251,23,240,73,32,2
020
1110 DATA 70,23,206,158,23,48,65,32,17
1120 DATA 170,25,32,105,23,169,255,141
,2040
1130 DATA 158,21,141,157,21,162,16,169
,1975
1140 DATA 47,157,68,3,169,24,157,69,18
1150 DATA 3,32,164,21,32,85,24,162,167
1160 DATA 21,169,0,133,212,133,214,169
,2211
1170 DATA 31,133,215,169,228,133,213,3
1180 DATA 119,24,32,70,24,169,0,141,17
1190 DATA 157,21,96,19,24,39,24,32,160
1200 DATA 85,24,169,0,133,214,133,212,
1210 DATA 169,228,133,215,169,31,133,2
13,2501
1220 DATA 162,21,208,18,58,24,135,24,1
1230 DATA 32,119,24,32,70,24,206,157,1
1240 DATA 21,76,117,32,32,102,24,88,17
1250 DATA 169,112,141,14,212,165,16,14
1,2220
1260 DATA 14,210,96,120,169,0,141,14,2
1270 DATA 212,141,14,210,173,1,211,41,
1280 DATA 254,76,107,24,173,1,211,9,21
1290 DATA 1,141,1,211,96,234,234,234,2
1300 DATA 234,32,180,25,96,160,0,177,2
204
1310 DATA 214,145,212,200,208,249,230,
213,2981
1320 DATA 230,215,202,208,242,96,63,25
1330 DATA 97,25,32,85,24,169,0,133,189
1340 DATA 212,133,214,169,29,133,213,1
69,2612
1350 DATA 192,133,215,162,16,32,119,24
,2243
```

1360 DATA 169,216,133,215,162,7,32,119,2413 1370 DATA 24,32,70,24,96,50,31,52,1749 1380 DATA 31,88,76,32,256,1863

#### CHECKSUM DATA.

(see page 90)

100 DATA 171,475,815,559,361,848,273,5
50,782,571,84,905,606,355,318,7673
250 DATA 469,840,402,92,894,770,196,81
0,817,638,62,606,490,351,808,8245
1100 DATA 324,565,759,811,552,255,773,630,491,200,521,851,362,321,511,7926
1250 DATA 623,301,490,524,339,359,139,825,278,829,783,814,76,405,6785

#### Assembly language listing.

```
O.S. EQUATES
ICBAL
ICBAH
NMIEN
IRQEN
CHSET
 D.D.S. EQUATES
DUPFLG
OPT
SFLOAD
MEMFLG
RRDUP
DUPSYS
CLOSX
CLOS20
DOS
                                    $159D
$159E
$1594
$179E
$1801
$182F
$1984
$1984
$2075
 MISC EQUATES
MSAVF = DOSSTART = MSAVT1 = MSAVT2 = SAVEDOS = TO = FROM =
                                   $1D00
$1F00
$C000
$D800
$E400
$D4
 DOS PATCHES
                        #= $157A
                        JMP DUPINIT
1
                         *= $1746
                        MWRITE
COPY CHR SET TO AUX MEMORY
                       LDA # <CHSET | SET UP

STA TO | INDIRECT

LDA # >CHSET | POINTERS

STA TO+1

LDY #*#00 | INIT REGS

LDA #*#03 | INIT REGS

LDA #*#03 | SAVE ACC

PHA (TO), Y | SAVE ACC

JSR ON | AUX MEM OF

PLA | IRESTORE ACC

STA (TO), Y | STORE ACC

JSR OFF | SAUX MEM OF
MOVECHR
                                                          SGET CHR
SSAVE ACC
AUX MEM ON
RESTORE ACC
& STORE
SAUX MEM OFF
LP1
                                                           FIF Y=0 THEN
FINC HI BYTE
DEC LOOP INDEX
                         BNE LP1
INC TO+1
DEX
                         BPL LP1
RTS
```

\*= \$17B6

```
BEQ RRDUP
JSR MWRITE
DEC MEMFLG
BMI RRDUP
                                           DO MEM, SAV
SHOW MEM SAVED
ALWAYS
 600D
 COLDSTART ROUTINE
JSR ON !AU
LDA #$### !MO'
STA FROM !FR'
STA TO
LDA # >SAVEDOS
STA FROM+!
LDA # >DOSSTART
STA TO+!
LDX ##15
BNE CONT
                                           JAUX MEM ON
MOVE DUP DOWN
JFROM AUX MEM
 RRDUP1
 .
                    *= $183A
  CONT
                    JSR MOVE
JSR OFF
DEC DUPFLG
JMP DOS
                                            AUX MEM OFF
SHOW DUP IN MEMORY
AND RUN IT
    ROUTINES TO ENABLE/DISABLE
aux mem (*c000-*ffff)
                   JSR AUXOFF
CLI
LDA ##70
STA NMIEN
LDA #10
STA IRQEN
RTS
 OFF
                   SEI
LDA ##00
STA NMIEN
STA IRQEN
LDA #D301
AND ##FE
JMP ST
 ĎΝ
                                            INO INTERRUPTS!
 AUXON
AUXOFF
                  LDA $D301
ORA #$01
STA $D301
RTS
NOP
NOP
NOP
NOP
    MEMSVQ TELLS DOS IF MEM.SAV IS ACTIVE (Y=1)
                  JSR CLOS20 ; CLOSE IOCB
RTS ; RETURN Y=1
MEMSVQ
    MOVE ROUTINE
CALLING ROUTINE SETS UP 'TO'
AND 'FROM' AND ON ENTRY X
IS NUMBER OF PAGES TO MOVE
                 LDY #####
LDA (FROM),Y
STA (TD),Y
INY
BNE LP
INC TO+1
INC FROM+1
DEX
BNE LP
RTS
MOVE
    RESTORE SAVED MEMORY
                  *= $193F
                  LDMEM1
    CHANGE DOS MENU TITLE BAR
TO REFLECT PATCHED DOS
                   *= $1F32
 ŧ
                   .BYTE "XL "
```

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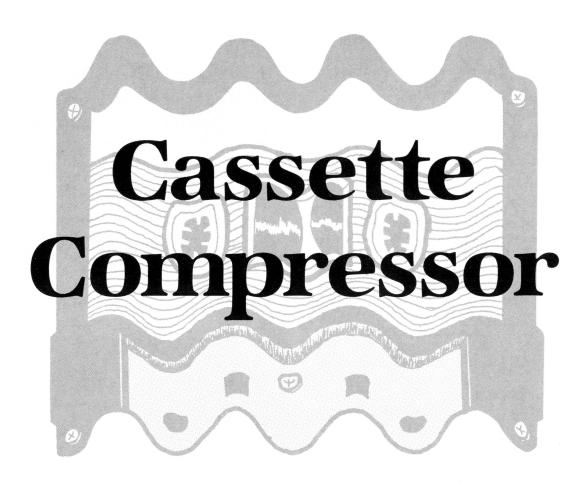
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#### 16K Cassette or Disk

#### by Harold Johnson

ANALOG Computing has established a sort of tradition—each issue contains a machine language game. The maker program provided writes the actual game to disk or cassette, but when writing to cassette, it uses the slowest possible way—long inter-record gaps. This is the same as typing in SAVE C: instead of CSAVE.

One day I got tired of waiting for my cassette boot programs to load, so I wrote the **Cassette Compressor**. It will take any program not longer than the amount of free RAM and "compress" it by rewriting it and using short inter-record gaps. This causes the program to load faster and to be more reliable.

As a test for the **Compressor**, I unplugged all of my RAM boards except one, leaving me with only 16K of RAM. I then loaded in the program **Crash Dive!** since it was the longest program published by **ANALOG Computing** up to that time. It fit quite easily into the system, leaving thousands of bytes free. After rewriting, **Crash Dive** loaded in only 27% of the original time. It also took up about a quarter as much tape. This gives even more reliability, since there is now less tape for errors to develop on.

#### Using the program.

First, type in the listing. It's pretty short, so you shouldn't have any problems. Next, CSAVE it a couple of times, so that you won't have to type it again the next time you want to use it. Now, just run the program. You will be prompted to insert the source cassette and press a key. The console will also beep once, reminding you to depress the PLAY button on your recorder. At this time, put the cassette containing the program to be compressed in, and rewind or advance the tape to the proper counter number.

Now, push down the PLAY button on the recorder and press RETURN. The computer will read in the source file, during which there will be a fairly long delay. When this is finished, the console will beep twice, and you will be asked to insert the destination cassette and press a key. Now, put in the destination cassette, rewind or advance the tape to the proper location, press the PLAY and RECORD buttons down on the recorder, and press RETURN. The computer will rewrite the whole file. When the computer finishes, the console will beep again, and you will be asked if you would like to write the same file again.

If you enter a Y, the computer will rewrite the file from memory (why read it again?), and this cycle will repeat. If you enter an N, you will be asked one more thing—Compress another file? If you enter a Y here, the program will rerun. If you enter an N, you will be returned to BASIC.

#### Notes.

There are just a couple of tricks employed in this program. In Line 10, the input/output noise is disabled via the POKE to location 65. POKEing a 1 to this location will turn it back on again (although I don't know why anyone would want to). This is documented in the regular BASIC reference manual from Atari. I have no idea why no one seems to use it.

Another trick is disabling the BREAK key. This just makes sure that, if you accidentally hit it, it won't mess up the I/O. This is done in Line 20 by the last two POKEs to memory locations 16 and 53774. If you use this disabling trick, however, remember that hitting SYSTEM RESET or changing graphics modes re-enables the BREAK key.

The last trick is in Lines 100 and 120. I use an input from IOCB #0. This channel is always open for BASIC itself, so, instead of opening channel 1, I use this. It also allows all screen editing features to be enabled without causing errors. Pretty neat, huh?

#### Listing 1.

```
10 POKE 752,1:POKE 65,0:? "Insert sour ce cassette and press any key.":A=FRE (0):IF A)32767 THEN A=32767
20 DIM A$(A-128):OPEN #1,4,0,"C:":POKE 16,64:POKE 53774,64
30 ? "Reading file...please wait.":TRAP 50:A=1
40 GET #1,B:A$(A)=CHR$(B):A=A+1:GOTO 4
50 CLOSE #1:? "Insert destination cassette and press any key."
60 OPEN #1,8,128,"C:"
70 ? "Writing file...please wait."
80 ? #1;A$;:CLOSE #1
90 ? "Done. Write same file again (Y N)"
100 INPUT #0;A$:IF A$="Y" THEN 50
110 ? "COMPRESS another file (Y/N)"
120 INPUT #0;A$:IF A$="Y" THEN RUM
```

#### CHECKSUM DATA. (see page 90)

10 DATA 232,907,420,648,697,539,79,410,92,987,704,214,35,5964

## **Attention Programmers!**

**ANALOG Computing** is interested in programs, articles, and software review submissions dealing with the Atari home computers. If you feel that you can write as well as you can program, then submit those articles and reviews that have been floating around in your head, awaiting publication. This is your opportunity to share your knowledge with the growing family of Atari computer owners.

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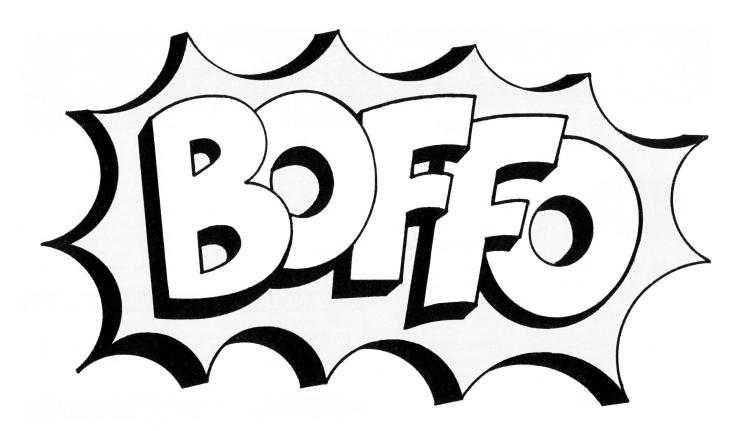
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16K Cassette or Disk

#### by Tom Hudson

Editor's note: This issue, Tom Hudson's **Boot Camp** gives way to **BOFFO**, a utility for assembly language programmers. **Boot Camp** readers are encouraged to study the use of **BOFFO** for next issue's **Boot Camp** column, which will examine the use of assembly language subroutines in BASIC.

For the assembly language programmer, there's probably no worse drudgery than converting object code into DATA statements for use in BASIC programs. This was a major concern for the ANALOG Computing programming staff (all of us being basically lazy), so BOFFO was developed and improved, a little bit at a time, over a period of about a year.

BOFFO will convert just about any file into DATA statements, so that it can be reconstructed or POKEd into memory by a BASIC program. The DATA statements can be created with a simple checksum if desired—a good idea for magazine programs, which are easily mistyped.

**BOFFO** is intended primarily for *experienced* programmers who would like an easy shortcut in generating BASIC DATA.

#### Using the program.

After typing in the accompanying program listing, check your typing with **D:CHECK2** and SAVE the program to disk.

When RUN, **BOFFO** will ask you several questions about what you want to do. Here's a brief explanation of each:

#### **OBJ/DATA** file?

If you're converting an assembler object file, type O and press RETURN; otherwise, type D and press RETURN.

Typing O will force **BOFFO** to read the machine language load header bytes, placing only actual memory bytes into the DATA statements. Note that the memory in your object file *must* be contiguous. That is, each group of loaded data must start loading in the first byte after the previous group. If not, an error message will result. Use the O option for object files *only*!

Typing *D* will cause **BOFFO** to place *every byte* of the file into the DATA statements. Use the D option for text files or object files which you'd like to completely reconstruct.

#### OBJECT filename? DATA filename?

Depending on whether you chose the O or D option, one of the above questions will appear. In either case, type in the name of the file you wish to convert. If you enter a filename without

a device, D1: is assumed.

#### BASIC filename?

At this point, enter the name of the file you want to create. This file will contain the BASIC DATA statements which correspond to the input file. If you have a printer, you can send the output to it by typing *P*:. Usually, you'll want to send the output to a disk file, like so: D:FILE-NAME.EXT.

Most errors in filename entry will be trapped, and you will be asked to try again.

#### Starting lineno?

Type in the line number you want the DATA statements to start on.

#### Line increment?

Type in the line number increment. For example, if you use a starting line number of 1000 and an increment of 5, the line numbers will proceed: 1000, 1005, 1010, and so on.

#### Decimal/Dex?

Typing *D* here will cause **BOFFO** to generate decimal (base 10) numbers in the DATA statements. This is the form of data that is used most often.

Typing *H* here will generate *hexadecimal* DATA statements, like those seen in most of **ANALOG Computing**'s assembly language games. The hexadecimal form saves a great deal of memory, but you must decode the hex values, which is a slow process. Look at any of **ANALOG Computing**'s assembly games to see how this is done.

#### Bytes per line?

Simply enter the number of data bytes you want on each DATA line. Usually, 25 is the maximum for decimal values, and 45 the maximum for hex. Of course, you could put only one byte on each line, but this would waste memory.

#### Checksum (Y/N)?

If you want **BOFFO** to generate checksum values, type Y and press RETURN. If not, type *N*.

The checksums generated by **BOFFO** are simple, modulo 1000 numbers. To get the checksum, add the value of each byte in the line to a counter. If the value of the counter ever exceeds 999, subtract 1000 from it. The checksum is placed after the last byte in each DATA line; simply READ it after you have read all the data bytes. Figure 1 shows the code necessary to process

checksums for DATA statements containing 25 bytes per line.

```
10 TRAP 100
20 FOR X=1 TO 25
30 READ BYTE
40 TOTAL=TOTAL+BYTE
50 IF TOTAL>999 THEN TOTAL=TOTAL-1000
60 NEXT X
70 READ CHKSUM
80 IF TOTAL<>CHKSUM THEN ? "DATA ERROR!"
90 GOTO 20
100 IF PEEK(195)=6 THEN ? "DATA OK!":E
ND
110 ? "DATA ERROR:";PEEK(195):END
```

#### Figure 1.

Note that the checksum values carry on from one DATA line to the next. In this way, if a line is missing, it can be detected and fixed.

You don't need checksums for your own programs. I usually only generate checksums if the finished program is going to be printed in **ANA-LOG Computing**, or where someone will have to type it in. Using checksums definitely helps the end user reduce typing errors.

Using the output.

After you've answered all **BOFFO**'s questions, it will generate the BASIC DATA and write it to the specified output file. When the READY prompt appears, you're ready to use the DATA.

To retrieve your newly-created BASIC code, you must ENTER it. The ENTER command is similar to LOAD, except that the code is *added* to whatever BASIC code is in memory. Type ENTER"D:FILE-NAME.EXT". The DATA code will be brought into memory, ready for you to use.

At the end of the DATA statements, **BOFFO** creates a REM statement which lets you know how many bytes were converted. This is a convenient way to tell how many bytes the program needs to READ.

#### Some final notes.

An important restriction in **BOFFO** is that data blocks in object data files *must* be contiguous. Otherwise, there is no way to determine where in memory the code resides.

Remember that **BOFFO** is meant for fairly advanced programmers. You should know what you want to do with the code once it is converted to DATA. If you don't know what "object code" is, **BOFFO** isn't for you.

I think most assembly language programmers will agree that **BOFFO** is a utility that's worth typing in. It has saved me literally hundreds of hours—and many headaches—when setting up **ANALOG Computing**'s assembly language games. Why translate all those bytes, when your Atari can do it for you?

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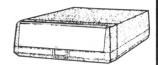
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#### BOFFO BASIC listing.

```
10 TRAP 40000:? "KASSEMBLY-TO-BASIC DA
TA CONVERTOR":? "4By Tom Hudson, ANALO
 6 COMPUTING"
20 DIM FILE$(15),FI$(17),D$(1),HX$(16),DH$(1),CK$(1),OD$(1),ODMSG$(6):HX$="0
  30 POSITION 2,5:? "[X] OBJ/DATA file";
:INPUT OD$:IF OD$="O" THEN ODMSG$="OBJ
:INPUT UDS:IF ODS="O" THEN ODMSG$="OBJ
ECT":GOTO 60
40 IF OD${}"D" THEN 30
50 ODMSG$=" DATA"
60 POSITION 2,7:? "\";ODMSG$;" filena
Me";:INPUT FILE$:TRAP 120:IF LEN(FILE$
)=1 THEN 90
  70 IF FILE$(2,2)=":" THEN FI$=FILE$:GO
 70 IF FILE$(2,2)=":" THEN FI$=FILE$:G0
T0 100
80 IF FILE$(3,3)=":" THEN FI$=FILE$:G0
T0 100
90 FI$="D:":FI$(3)=FILE$
100 OPEN #1,4,0,FI$:IF OD$="O" THEN GE
T #1,BYTE:GET #1,BYTE2:IF BYTE<>255 OR
BYTE2<>255 THEN 130
 110 GOTO 150
120 ? FILE$;" INVALID FILE,";:GOTO 140
130 ? FILE$;" NOT OBJ FILE,";
140 ? " PRESS RETURN";:INPUT D$:CLOSE
 #1:GOTO 60
 150 POSITION 2,9:? "[X] BASIC filename";:INPUT FILE$
160 TRAP 200:IF FILE$(2,2)=":" THEN FI$=FILE$:GOTO 190
170 IF FILE$(3,3)=":" THEN FI$=FILE$:G
170 IF FILE$ (3,3)=":" THEN FI$=FILE$:G
0TO 190
180 FI$="D:":FI$ (3)=FILE$
190 OPEN #2,8,0,FI$:GOTO 210
200 ? FILE$;" INVALID FILE, PRESS NAME
NOTE: INPUT D$:CLOSE #2:GOTO 150
210 POSITION 2,11:? "MStarting lineno";:TRAP 210:INPUT LINE:TOTAL=0
220 POSITION 2,13:? "M Line increment";:TRAP 220:INPUT INC
230 POSITION 2,15:? "M Decimal/Mex";:INPUT DH$:IF DH$
  THEN 230
 240 POSITION 2,17:? "T Bytes per line
";:TRAP 240:INPUT BLIN
250 POSITION 2,19:? "T Checksum (Y/N)
";:INPUT CK$:IF CK$<>"Y" AND CK$<>"N"
THEN 250
260 COUNT=0:TRAP 420
270 IF OD$="D" THEN LA=0:HA=65535:TOTL
EN=65536:TLC=-1:GOTO 310
280 GET #1,LO1:GET #1,HI1:GET #1,LO2:G
ET #1,HI2:LA=LO1+HI1*256:HA=LO2+HI2*25
6:TOTLEN=HA-LA+1:TLC=-1
290 IF HA=737 AND LA=736 THEN 420
300 IF COUNT>0 AND LA<>LL+1 THEN ? "5
ERRORIED MEMORY NOT CONTIGUOUS!":END
310 LL=HA:IF TOTAL>0 THEN 330
320 X=-999
330 TLC=TLC+1:IF TLC=TOTLEN THEN 270
  THEN 250
 330 TLC=TLC+1:IF TLC=TOTLEN THEN 270
340 GET #1,BYTE:TOTAL=TOTAL+1:COUNT=CO
UNT+1:GNDTOT=GNDTOT+BYTE:IF CK$="Y" AN
 D GNDTOT>999 THEN GNDTOT=GNDTOT-1000
350 IF X=-999 THEN ? #2;LINE;" DATA ";
!LINE=LINE+INC:X=0
360 IF DH$="D" AND X>0 AND X<BLIN THEN
? #2;",";
? #2;",";
370 X=X+1:IF DH$="H" THEN BH=INT(BYTE/
16):BL=BYTE-(BH*16):? #2;HX$(BH+1,BH+1);HX$(BL+1,BL+1);:GOTO 390
380 ? #2;BYTE;
390 IF X{BLIN THEN 330
400 IF CK$="N" THEN ? #2:GOTO 320
410 ? #2;",";GNDTOT:GOTO 320
420 IF PEEK(195) <>136 AND PEEK(195) <>0
THEN ? "KJABNORMAL TERMINATION (ERROR ";PEEK(195);")":END
430 IF CK$="N" OR X=-999 THEN 490
440 IF DH$="D" THEN 470
450 ? #2;"00";:TOTAL=TOTAL+1:X=X+1:IF
X{BLIN THEN 450
 X BLIN THEN 450
```

460 GOTO 480 470 ? #2;",0";:TOTAL=TOTAL+1:X=X+1:IF X{BLIN THEN 470 480 ? #2;",";GNDTOT 490 ? #2:? #2;LINE;" REM \* ";TOTAL;" B YTES":CLOSE #1:CLOSE #2:END

#### CHECKSUM DATA.

(see page 90)

10 DATA 16,177,337,993,432,855,216,221,32,650,701,698,588,720,389,7025
160 DATA 840,704,251,659,579,218,841,709,139,513,652,643,195,147,504,7594
310 DATA 764,586,912,363,980,825,589,835,89,10,703,491,184,726,662,8719
460 DATA 737,660,627,18,2042

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## The Latest Innovations From CDY For Your Atari 400/800/800XL

#### **OMNIMON! Resident Monitor**

OMNIMON! is a PC board which plugs into your 400/800 (soon to be available for the XLs also) and gives you complete control of your computer. Even though it is always available (by pressing SELECT and SYSTEM RESET) it takes up no user memory because it resides in the unused 4K block at \$C000. Use it to interrupt, examine, and manipulate any program in memory whether it be disk, cassette, or cartridge based. It is especially good for program development or customization of existing programs. The flexible disk I/O allows you to write to or read from disk in either single or double density. You can edit raw sector data or even load a file without DOS. Many debugging tools are at your disposal: Display / Alter memory or 6502 registers, Disassemble memory, Search memory, Hex/Char modes, Single Step execution, JSR or GOTO address, Push / Pull stack, Printer dump, etc. After interrupting a program with OMNIMON!, many times it is possible to return to the program as if you had never left it (e.g., BASIC, DOS, etc.). Instructions are provided for the addition of a simple toggle switch to make OMNIMON! invisible, thus making it compatible with all software. An external cable is now provided to eliminate the need to solder directly on the board.

#### New 8K OMNIMON! Upgrade

This enhancement, which is available to all OMNIMON! users, includes a substantial number of features not available in the standard version. The 8K OMNI resides in an 8K ROM which has been modified by the addition of a switch for selecting either of two 4K banks. The additional features include Hex Conversion and Hex Arithmetic, Block Move, a Relocater, and a Line Assembler. A Binary Load command allows you to load any binary load file without DOS and doubles as a disk directory command which prints out the start sector of each file. Lockup recovery allows you to recover from system lockup, meaning that when your computer freezes, you can usually salvage the program or text file in memory by popping into 8K OMNI and dumping memory to disk. Advanced users will like the user extendibility feature which allows them to make use of the interface routines of 8K OMNI in their own software. One of the most exciting features of the 8K OMNI is the resident Ramdisk handlers. They allow AXLON Ramdisk owners to use this powerful device with any DOS which uses standard SIO calls and even with boot programs like word processors and games which access the disk a lot. Several additional features make this version very valuable for advanced programmers, but if you have a Ramdisk, 8K OMNI is a MUST!

#### New OMNIVIEW 80 Column Upgrade

Did you know that for most applications you do not need an expensive, slot consuming 80 column board to enjoy the power of 80 columns? Would you 400 owners like the convenience of 80 columns? OMNIVIEW takes advantage of the high resolution graphics mode built into the ATARI to generate an 80 column screen editor essentially identical to the ATARI screen editor (E., S:). Thus, you can use OMNIVIEW in any environment where you would normally use the 40 column "E:" (e.g., BASIC, Assembler / Editor, etc.). The 80 column "E:" of OMNIVIEW has been optimized for speed so that it is not significantly slower than 40 column "E:". In addition, the character font was specially designed to be legible on an ordinary TV set! A monitor is recommended, but not really necessary for casual 80 column operation. The Bit-3 version of LJK's 80 column Letter Perfect has been modified to support OMNIVIEW and other programs are sure to follow. Lastly, the Ramdisk handlers described under 8K OMNI are also incorporated in OMNIVIEW.

#### **New RAMROD-XL**

800XL owners are now able to equip their computers with OMNIMON and OMNIVIEW. In addition, the Newell enhanced operating system and Fastchip floating point package will be included at no extra charge. This will essentially turn your 800XL back into a 400/800 compatible machine and allow it to run most of the software which the XL-OS will not. A switch will allow you to select the XL-OS when needed.

	OMNIMON Piggy-back 400/800	Ramrod OS Board 800	OM		or Ramrod 4K VIEW	Ramrod-XL Piggy-back 800XL	Addon for Ramrod-XL VIEWXL
Enhanced OS w/Fast Cursor		+				+	+
Includes FASTCHIP FP						+	+
80 Columns Emulation				+	+		+
AXLON Ramdisk Handlers			+	+	+		
OMNIMON Features:							
A:Alter Memory	+	+	+	+		+	
B:Boot (Ram) disk			+	+	+		
C:CPU Registers	+	+	+	+		+	
D:Display Memory	+	+	+	+		+	
E:Single Step Execution	+	+	+	+		+	
F:Fill Program Buffer			+			+	
G:Binary Load / Directory			+			+	
H:Hex Conversion			+	+		+	
H:Hex Arithmetic			+			+	
I:Install Ramdisk Handlers			+	+	+		
J:Jump Subroutine (JSR)	+	+	+	+		+	
L:Drive Selection/Control	+	+	+	+		+	
M:Move Block of Memory			+			÷	
N:Relocate 6502 Code			+			+	
O:Operate from Program Buffer			+			+	
P:Printer Control	+	+	+	+		+	
R:Read Sector(s) from Disk	+	+	+	+		+	
S:Search Memory for Sequence	+	+	+	+		+	
T:Toggle Hex/Char Display Mode	+	+	+	+		+	
U:User's Custom Command			+				
V:Verify 2 Blocks of Memory			+	+		+	
W:Write Sector(s) to Disk	+	+	+	+		+	
X:Disassemble Memory	+	+	+	+		+	
Y:Line Assembler			+			+	
Z:Exit Monitor			+				
Lockup Recovery			+	+		+	
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BASIC-XL, MAC65, ACTION!	\$75.00

#### **Newell RAMROD OS Board**

This is a new operating system board which replaces the existing OS board. It allows you to use EPROMs in place of the ATARI OS ROMs and comes with an enhanced OS which includes additional graphics modes and a fast cursor. It also has a socket which will accept any version of OMNIMON and thus is an alternative to the OMNIMON! piggyback board. For the 800 only.

RAMROD OS Board with Standard OMNIMON	\$149.95
RAMROD OS BOARD WITH STANDARD OMINIMON	\$149.93
RAMROD OS Board with 8K OMNIMON or 8K OMNIVIEW	\$189.95
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# Bopotron Construction Set

16K Cassette or Disk

by Kyle Peacock

This article and program listing are to be used in conjunction with **Bopotron** on page 33. The **Construction Set** will allow you to enter, save and edit the levels you've created and incorporate them into the game. The manner in which you create your own levels may seem overwhelming at first, but — with a little patience — you and your friends will be bopping your brains out.

First, let's examine the graphics mode 0 graph paper found on page 58. You are free to photocopy this page for the creation of **Bopotron** levels. Any other photocopying of the magazine infringes on copyright laws, which could put you in a lot of hot water. The remainder of this article will be based on the numbers found at the top and leftmost side of the graph. These will be called the X and Y coordinates, respectively. Notice how rows 0 through 3 and column 39 have been shaded off. These areas are unavailable for use by the **Bopotron** designer. The program doesn't check to see if you're using these areas or not, so it's totally the designer's responsibility.

Initially, you must specify where the **Construction Set** is to put the level specific output it will generate. There are four options available. They are: screen (E:), printer (P:), disk drive (D:FILENAME.EXT) or cassette (C:). The characters in parentheses represent the required input for the particular device.

Next, specify the level number you are designing. There are six steps to designing your own **Bopotron** levels. They are: power-up, girder placement, ladder

placement, power pack placement, power unit placement and platform programming. Each of these steps will be explained in detail along with specific examples from the graph of level 1 on page 66.

#### Power-up.

This step involves setting the initial conditions for a particular level. You must first specify the Bopotron's starting X and Y coordinates. Given this X and Y, the Bopotron's left footpad will appear on that coordinate. An initial and maximum power setting must then be input. When the level begins, the Bopotron will have an initial internal power level. Charging at a power pack will allow the Bopotron to accumulate energy up to the maximum setting. Next, the exit girder position must be specified. Bopping onto the exit girder, after energizing all of the power units, will allow you to proceed to the next level.

#### Girder placement.

This step involves the placement of all girders for a particular level. First, input the number of girder segments present for the level being designed. A girder segment is of variable length but must be contiguous. Level 1 has nine girder segments.

The format for girder placement is as follows: starting X coordinate, ending X coordinate and a Y coordinate. The starting X must be smaller than the ending X. For example, level 1 has a girder segment from X position 0 to 8 at a Y position of 4. Using the Construction Set, you would type:

#### GIRDER 1 POSITION :0,8,4

The remainder of the girder segments would follow the same format.

#### Ladder placement.

This segment involves the placement of ladders onto a particular level. First, input the number of ladder segments present on the level being designed. A ladder segment is of variable length but must be contiguous. Ladders consist of three horizontal characters side by side. For this reason, the maximum X coordinate for any ladder would be 36 (since column 39 is unavailable for use). Level 1 has four ladder segments.

The format for ladder placement is as follows: starting Y coordinate, ending Y coordinate and a leftmost X coordinate. The starting Y must be smaller than the ending Y. For example, level 1 has a ladder segment at Y position 4 to 9, at an X position of 27. Using the **Construction Set**, you would type:

#### LADDER 1 POSITION :4,9,27

The remainder of the ladder segments would follow the same format.

#### Power pack placement.

This step involves the placement of all power packs for a particular level. First, input the number of power packs present for the level being designed. A power pack consists of four characters arranged as a  $2\times2$  square. Level 1 has one power pack.

The format for power pack placement is as follows: lower left X coordinate, lower left Y coordinate. Given this X and Y designation, the lower left character of the  $2\times2$  square will appear at this position. For example, level 1 has a power pack at an X position of 0 and a Y position of 23. Using the **Construction Set**, you would type:

#### POWER PACK 1 POSITION :0,23

The remainder of the power packs would follow the same format.

#### Power unit placement.

This step involves the placement of all power units for a particular level. First, input the number of power units present for the level being designed. A power unit consists of four characters arranged as a  $2\times2$  square. Level 1 has 2 power units.

The format for power unit placement is as follows: lower left X coordinate, lower left Y coordinate. Given this X and Y designation, the lower left character of the 2×2 square will appear at this position. For example, level 1 has a power unit at an X position of 3 and a Y position of 9. Using the **Construction Set**, you would type:

#### POWER UNIT 1 POSITION :3,9

The remainder of the power units would follow the same format.

#### Platform programming.

This step involves the programming of the multivector maintenance platforms. Any level can have up to two platforms. Each platform can have up to five vectors, for a total of ten pre-programmed vectors. Those of you unfamiliar with vectors are encouraged to read Tom Hudson's **BASIC Training** article in issue 18 (page 69). The platforms follow the simple X-Y matching algorithm found there.

Platform programming is accomplished by first specifying the number of platforms present for the level being designed. Next, the number of vectors for each platform is specified. Finally, the coordinates of each vector are input. The format for platform vectoring is as follows: origin X, origin Y, destination X, destination Y, speed.

Each platform takes up two characters horizontally. The vector coordinates designate where the left side of the platform will be positioned. As mentioned earlier, simple X-Y matching is incorporated, so the origin and destination can be located anywhere on the graph.

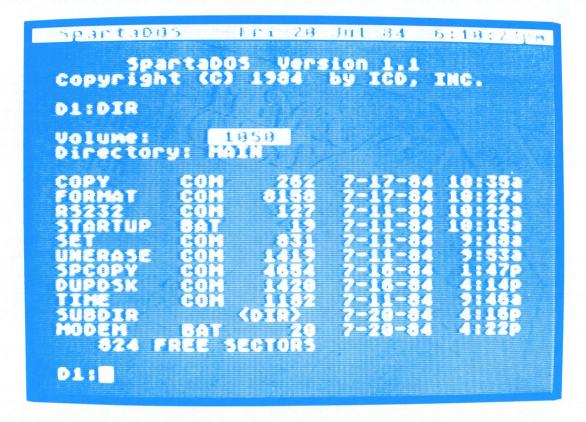
The speed parameter mentioned above designates how often the platform moves. This value is in jiffies (1/60 second). A value of 1 will cause the platform to (continued on page 67)

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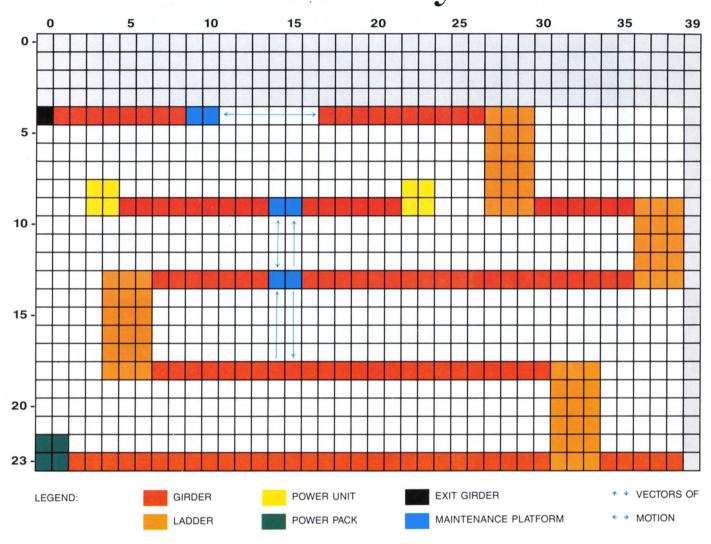
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## **Bopotron Construction Set** Screen #1 Layout



#### **BOPOTRON CONSTRUCTION SET**

#### **POWER-UP**

LEVEL #1 BOPOTRON LOCATION (X,Y):0,4 **INITIAL POWER:500** MAXIMUM POWER:500 EXIT GIRDER POSITION (X,Y):0,4

#### GIRDER PLACEMENT

GIRDER 1 POSITION:0,8,4 GIRDER 2 POSITION: 17, 26, 4 GIRDER 3 POSITION :3, 13,9 GIRDER 4 POSITION :16,23,9 GIRDER 5 POSITION: 30,35,9 GIRDER 6 POSITION:7, 13, 13 **GIRDER 7 POSITION :16,35,13** GIRDER 8 POSITION :7,30,18 GIRDER 9 POSITION:0,38,23

#### LADDER PLACEMENT

LADDER 1 POSITION: 4.9.27 LADDER 2 POSITION: 9, 13, 36 LADDER 3 POSITION:13,18,4 LADDER 4 POSITION:18,23,31

#### POWER PACK PLACEMENT

POWER PACK 1 POSITION: 0.23

#### **POWER UNIT PLACEMENT**

POWER UNIT 1 POSITION: 3.9 POWER UNIT 2 POSITION: 23.9

#### PLATFORM PROGRAMMING

PLATFORM:1

NUMBER OF VECTORS: 3

VECTOR 1 TRAJECTORY :14, 17, 14, 9, 2 VECTOR 2 TRAJECTORY :14,9,14,13,1 VECTOR 3 TRAJECTORY: 14, 13, 14, 17, 1

PLATFORM:2

NUMBER OF VECTORS: 2

VECTOR 1 TRAJECTORY: 9,4,15,4,1 VECTOR 2 TRAJECTORY: 15,4,9,4,3 advance once every 60th second. A value of sixty will cause it to move once a second. A value of zero will probably foul things up.

Once you've input all the level-specific information, the program will generate the DATA statements for that level on the output device specified. To incorporate your new level into the game, simply LOAD **Bopotron** into memory as usual. Next, if you're using a cassette or disk drive, load your new level into memory, using the ENTER command. Finally, increment the MAXLEVEL variable on Line 160 and SAVE the game again. Those with 16K should only specify the level they're designing as being from 1 to 5. Memory limitations allow for a maximum of five levels on 16K machines.

#### Editing levels.

Editing a level is accomplished by skipping over certain sections of the Construction Set and only entering values for updated data. Assuming the use of disk, this newly-edited data must have a different filename than the original level. For example, let's say that you designed a level where everything was working properly except for a misplaced ladder. When asked for the **Bopotron** starting position during the power-up section, enter 0.0. This will cause you to advance to the girder placement section. Enter 0 for the number of girders. This will advance you to the ladder placement section. Now, re-enter all of the information regarding ladders for that level. Next, enter 0 for the number of power packs, power units and platforms in the corresponding sections. The Construction Set will then generate output for the ladder placement section only. Once this is written to the specified device, assuming cassette or disk, type NEW. Now load the old level data into memory, using the ENTER command. Next, ENTER the newly edited data into memory. Finally, save the entire block of data to the output device, using the LIST command. Now your level is complete and ready to be loaded.

#### Become a Bopotron Brigadier.

Those of you with a little imagination and ambition are encouraged to put on your brain bubbles. Future issues of ANALOG Computing will publish additional levels for Bopotron from our readers. If you think you can bop with the best, send in the output generated by the Construction Set on either disk, cassette or printout. No hand-written output, please. Cassettes and disks will be returned if accompanied by a self-addressed, stamped envelope. All levels must be completable, and the designer's name should be specified. Send your output to:

Bopotron's Boogie Brigade (BBB) ANALOG Computing P.O. Box 23 Worcester, Ma 01603

Who knows? Maybe your name will appear in the pages of **ANALOG Computing**.  $\square$ 

```
100 REM ******************
100 KEN ACCOUNTS
110 REM *
120 REM * BOPOTRON CONSTRUCTION SET
130 REM * BY KYLE PEACOCK
149 REM * ANALOG COMPUTING
 150 REM
                              *********
 160 REM
 170 REM
180 TRAP 890
190 TRAP 076
190 DIM FILE$(15),D$(6),X$(10),G(150),
L(150),B(150),P(150),V(150),X(150)
200 REM *** OUTPUT DEVICE
210 D$=" DATA ":X$="C:D:P:E:5:"
220 GOSUB 870:? "DEVICE FILENAME IS ";
220 GOSUB 870:? "DEVICE FILENAME IS ";
:INPUT #16; FILE$
230 FOR X=1 TO 9:IF X$(X,X+1)=FILE$(1,
2) THEN 260
240 NEXT X:GOTO 890
250 REM *** LEVEL
260 GOSUB 870:POSITION 16,1:? "PONER—U
D":? :? "LEVEL # ";:INPUT #16;LVL
270 REM *** BOPOTRON LOCATION
280 ? :? "BOPOTRON LOCATION (X,Y) :";:
INPUT #16; BOPX, BOPY:IF BOPX=K0 AND BOP
Y=K0 THEN 310
 Y=K0 THEN 310
290 ? :? "INITIAL POMER :";:INPUT #16;
PMR:? :? "MAXIMUM POMER :";:INPUT #16;
 MAXPHR
300 ? :? "EXIT GIRDER POSITION (X,Y) :
300 ? :? "EXIT GIRDER POSITION (X,Y):
";:INPUT #16;XITX,XITY
310 REM *** GIRDER DRAM
320 GOSUB 870:POSITION 12,1:? "GIRDER
PLACEMENT":?
330 ? "NUMBER OF GIRDERS :";:INPUT #16
;GIRAMT:IF GIRAMT>50 THEN 330
340 IF GIRAMT<=0 THEN 380
350 ? :? "GORNAME STARTING X, ENDING X
,Y":?
 360 ?::FOR X=1 TO GIRAMT:XX=(X-1)*3:?
"GIRDER ";X;" POSITION :";:IMPUT #16;A
,B,C:G(XX+1)=A:G(XX+2)=B:G(XX+3)=C
370 NEXT X
380 REM *** LADDER DRAM
300 KEM *** LADDER DRAW
390 GOSUB 870:POSITION 12,1:? "LADDER"
PLACEMENT":?
400 ? "NUMBER OF LADDERS :";:INPUT #16
;LADAMT:IF LADAMT>50 THEN 360
410 IF LADAMT<=0 THEN 450
420 ?:? "FORMATH STARTING Y, ENDING Y
, X":?
430 ? :FOR X=1 TO LADAMT:XX=(X-1)*3:?
"LADDER ";X;" POSITION :";:INPUT #16;A
,B,C:L(XX+1)=A:L(XX+2)=B:L(XX+3)=C
440 NEXT X
450 REM *** POWER PACK DRAW
460 GOSUB 870:POSITION 10,1:? "POWER P
ACK PLACEMENT":?

470 ? "NUMBER OF POWER PACKS :";:INPUT #16;BATAMT:IF BATAMT>50 THEN 32767

480 IF BATAMT = THEN 510

490 ? :? "FORMATT LOWER LEFT X, LOWER
470 : : " "AUXILIAMY LUNCK LEFT X, LUNCK
LEFT Y": ?
500 ? :FOR X=1 TO BATAMT:XX=X*2-1:? "P
OMER PACK ";X;" POSITION :";:INPUT #16
;A,B:B(XX)=A:B(XX+1)=B:NEXT X
  510 REM *** POWER UNIT DRAW
  520 GOSUB 870:POSITION 10,1:? "POHER U
NIT PLACEMENT":?

NIT PLACEMENT":?

530 ? "NUMBER OF POWER UNITS :";:INPUT #16;PWRAMT:IF PWRAMT>50 THEN 530

540 IF PWRAMT(=0 THEN 570

550 ? :? "FORMATH LOWER LEFT X, LOWER LEFT Y":?
560 ? :FOR X=1 TO PWRAMT:XX=X*2-1:? "P
OMER UNIT ";X;" POSITION :";:INPUT #16
;A,B:P(XX)=A:P(XX+1)=B:NEXT X
570 REM *** PLATFORM PROGRAMMING
570 REM *** PLATFORM PROGRAMMING
580 GOSUB 870:POSITION 10,1:? "PLATFOR
M PROGRAMMING":?
590 V(1)=0:PLUS=1:? "NUMBER OF PLATFOR
M5 :";:INPUT #16;PLRAMT:IF PLRAMT(0 OR
PLRAMT)2 THEN 590
600 IF PLRAMT=0 THEN 690
610 V(PLUS)=PLRAMT:PLUS=PLUS+1
620 FOR X=1 TO PLRAMT:? :? "PLATFORM !!"
630 ? :? "NUMBER OF VECTORS :";:IN
#16;VEC:IF VEC<1 OR VEC>5 THEN 630
```

```
640 V(PLUS)=VEC:PLUS=PLUS+1
650 ? :? "#ORNATH ORIGIN X, ORIGIN Y,"
:? " DESTINATION X, DESTINATION
Ϋ́,";? "
7,":? " SPEED"
660 ? :FOR Y=1 TO VEC:? "VECTOR ";Y;"
TRAJECTORY :";:INPUT #16;A,B,C,D,E
670 V(PLUS)=A:V(PLUS+1)=B:V(PLUS+2)=C:
V(PLUS+3)=D:V(PLUS+4)=E:PLUS=PLUS+5
V(PLUS+3)=D:V(PLUS+4)=E:PLUS=PLUS+5
680 NEXT Y:NEXT X:HOLD=PLUS-1
690 REM *** DISPLAY OUTPUT
700 GOSUB 870:? "GENERATING OUTPUT, PL
EASE WAIT...";:OPEN #1,8,0,FILE$
710 IF BOPX=K0 AND BOPY=K0 THEN 740
720 PRINT #1;2080+(20*LVL);D$;BOPX;","
;BOPY;",";PMR;",";MAXPMR
730 PRINT #1;3080+(20*LVL);D$;XITX;","
***TTY
  XIT
;XITY
740 OFF=4080:AMOUNT=GIRAMT:MAX=GIRAMT*
3:FOR X=1 TO 150:X(X)=G(X):NEXT X:GOSU
   800
750 OFF=5080:AMOUNT=LADAMT:MAX=LADAMT*
3:FOR X=1 TO 150:X(X)=L(X):NEXT X:GOSU
760 OFF=6080:AMOUNT=BATAMT:MAX=BATAMT*
2:FOR X=1 TO 150:X(X)=B(X):NEXT X:GOSU
8 888
770 OFF=7080: AMOUNT=PWRAMT: MAX=PWRAMT*
2:FOR X=1 TO 150:X(X)=P(X):NEXT X:GOSU
   800
788 OFF=8080:AMOUNT=V(1):MAX=HOLD:FOR
X=1 TO 150:X(X)=V(X):NEXT X:GOSUB 800
790 END
       COUNT=0+1*(OFF=8080):IF AMOUNT=0 T
RAG
HEN 860
810 PLUS=0:GOSUB 880:PRINT #1;AMOUNT;"
820 COUNT=COUNT+1:PRINT #1;X(COUNT);
```

830 IF COUNT/25=INT(COUNT/25) THEN PLU
5=PLU5+1:IF COUNT(>GIRAMT\*MAX THEN PRI
NT #1;"":GOSUB 880:GOTO 820
840 IF COUNT=MAX THEN PRINT #1;"":GOTO
860
850 PRINT #1;",";:GOTO 820
860 RETURN
870 ? "%":POSITION 8,0:? "BOPOTRON CON
STRUCTION SET":? :RETURN
880 PRINT #1;OFF+(20\*LVL)+PLU5;" DATA
";:RETURN
890 ? "%":POSITION 6,1:? "ABNORMAL PRO
GRAM TERMINATION"

#### CHECKSUM DATA.

(see page 90)

100 DATA 778,241,359,359,519,253,796,9
5,755,634,599,974,123,903,891,8279
250 DATA 186,853,49,499,922,966,974,94
1,725,393,30,544,783,967,941,9773
400 DATA 619,365,25,511,776,616,546,49
2,387,257,385,679,603,161,443,6865
550 DATA 247,604,489,662,415,297,442,1
48,209,982,265,117,3,191,563,5634
700 DATA 163,560,614,547,828,768,791,9
35,907,65,837,385,32,635,503,8570
850 DATA 126,613,8,199,757,1703

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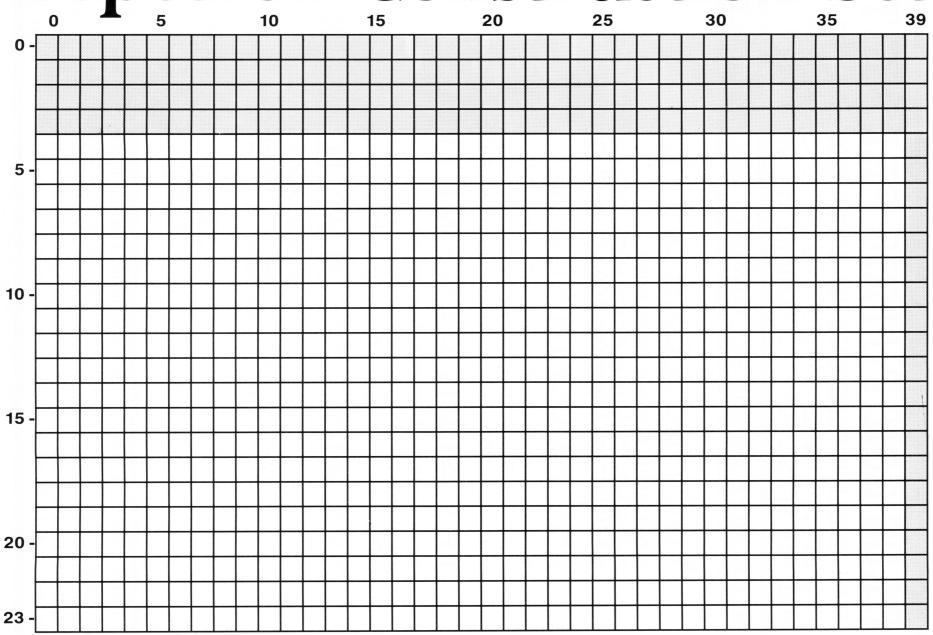
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16K Cassette or 24K Disk

by Charles Bachand

This month's assembly language game, Race in Space, is a two-player game with options that allow 128 different variations.

You and a friend (or enemy) must tace your space-ships through a densely-packed asteroid field. If your ship makes contact with any other object, it will be damaged and must return to its launch point. Race in Space is a semi-violent game, where no one gets killed.

Typing it in.

Before typing anything, look at the listings accompanying this article.

Listing I is the BASIC data and data checking routine. This listing is used to create both cassette and disk versions of Race in Space. The data statements are listed in hexadecimal (base 16), so the program will fit in 16K cassette systems.

Listing 2 is the assembly language source code for the game of Race in Space, created with the OSS MAC/65 assembler. You don't have to type this listing to play the game! It is included for those readers interested in assembly language.

Follow the instructions below to make either a cassette or disk version of **Race in Space**.

# Cassette instructions.

- 1. Type Listing 1 into your computer using the BASIC cartridge and verify your typing with Unicheck (see page 90).
- 2. Type RUN and press RETURN. The program will begin and ask:

# MAKE CASSETTE (0) OR DISK (1)?

Type 0 and press RETURN. The program will begin checking the DATA statements, printing the line number of each as it goes. It will alert you if it finds any problems. Fix any incorrect lines and re-RUN the program, if necessary, until all errors are eliminated.

- 3. When all of your DATA lines are correct, the computer will beep twice and prompt you to READY CASSETTE AND PRESS RETURN. Now, insert a blank cassette in your recorder, press the RECORD and PLAY buttons simultaneously and hit RETURN. The message WRITING FILE will appear, and the program will create a machine language boot tape version of Race in Space, printing each DATA line number as it goes. When the READY prompt appears, the game is recorded and ready to play. CSAVE the BASIC program onto a separate tape before continuing.
- 4. To play the game, rewind the tape created by the BASIC program to the beginning. Turn your computer OFF and remove all cartridges. Press the PLAY button on your recorder and turn ON your computer while holding down your START key. If you have a 600 or 800XL computer, you must hold the START and OPTION keys when you turn on the power. The computer will "beep" once. Hit the RETURN key, and Race in Space will load and run automatically.

# Disk instructions.

- 1. Type Listing 1 into your computer, using the BASIC cartridge and verify your typing with Unicheck (see page 90).
- 2. Type RUN and press RETURN. The program will ask:

# MAKE CASSETTE (0) OR DISK (1)?

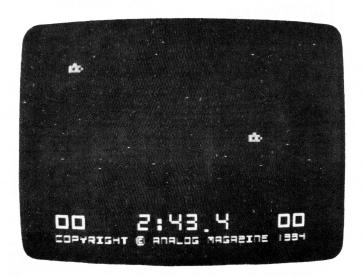
Type 1 and press RETURN. The program will begin checking the DATA lines, printing the line number of each statement as it goes. It will alert you if it finds any problems. Fix incorrect lines

and re-RUN the program, if necessary, until all errors are eliminated.

- 3. When all DATA lines are correct, you will be prompted to *INSERT DISK WITH DOS*, *PRESS RETURN*. Put a disk containing DOS 2.0S into drive #1 and press RETURN. The message *WRITING FILE* will appear, and the program will create an AUTORUN.SYS file on the disk, displaying each DATA line number as it goes. When the READY prompt appears, the game is ready to play. Be sure the BASIC program is SAVEd before continuing.
- 4. To play the game, insert the disk containing the AUTORUN.SYS file into drive #1. Turn your computer OFF, remove all cartridges and turn the computer back ON. Race in Space will load and run automatically.

# Playing the game.

Race in Space requires the use of two joysticks plugged into ports 1 and 2. When the game starts, you are presented with a scrolling title screen. To enter the game options screen from either the intro screen or the game play screen, simply press OPTION.



Race in Space.

When in the options menu, use the OPTION key to select which option to change, and then use the SELECT key to change it. Use the START key to begin game play. While in the options menu, you may also press one of the number keys from 1 to 9 to change the time limit for the game from the default of three minutes. All selected options will remain in effect for subsequent game plays.

# Game options.

Race in Space has five options that can be changed within the options menu to suit your own personal tastes. These options have been broken down for you here:

1. **Trigger** — NO EFFECT renders the trigger button completely useless.



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SHIELDS will put up a protective barrier around your ship that will allow objects to pass through it without harm. Unfortunately, all the power from your engines will be used to run the shields, thus leaving you dead in space.

MISSILES allow both you and your opponent to fight it out in outer space using mega-menace Boomerang missiles, which automatically lock onto your enemy's coordinates when fired. To save yourself, you must move your ship out of the path of the oncoming missile. Only one missile per ship is allowed on the screen at any one time. You may fire a missile when the top of your ship has a "knob" on it (this is your missile). Every time your missile hits your opponent's ship, or is absorbed by a comet (see COMETS), you will receive one point.

WARP DRIVE allows your ship to travel at twice its normal cruising speed, using its wavemotion engine. At this speed, you must be twice as careful.

- 2. Density This varies the number of asteroids present on the game screen. Choosing from STANDARD, DOUBLE, TRIPLE or SU-PER will increase the number of asteroids, thereby increasing their density on the playfield and the game difficulty.
- 3. Comets Comets can either be ENABLED or DISABLED and roar across the screen at random intervals. You can hear a comet as it approaches, and as it travels across the screen.
- 4. Universe You will normally fly through a POSITIVE universe, one that is very stable. This is the default setting and the one that you will, most likely, use. Adventurous people can explore the dangers of a NEGATIVE universe, where space itself will flash at random intervals.

Every time your ship reaches the top of the screen, a new one will reappear at the bottom—at your launch site—and you will be awarded one point. The winner is simply the player with the most points at the end of the game. Race in Space will end when either player reaches 99 points, or you run out of time. Good luck; you'll need it! □

# Listing 1. BASIC listing.

10 REM \*\*\* RACE IN SPACE \*\*\*
20 TRAP 20:? "MAKE CASSETTE (0), OR DI
5K (1)";:INPUT D5K:IF D5K>1 THEN 20
30 TRAP 40000:DATA 0,1,2,3,4,5,6,7,8,9
,0,0,0,0,0,0,10,11,12,13,14,15
40 DIM DAT\$(91),HEX(22):FOR X=0 TO 22:
READ N:HEX(X)=N:NEXT X:LINE=990:RESTOR
E 1000:TRAP 120:? "CHECKING DATA"
50 LINE=LINE+10:? "LINE:";LINE:READ DA
T\$:IF LEN(DAT\$) <> 90 THEN 220
60 DATLIN=PEEK(183)+PEEK(184)\*256:IF DATLIN</br>
61 LINE THEN ? "LINE ";LINE;" MISS

70 FOR X=1 TO 89 STEP 2:D1=ASC(DAT\$(X, X))-48:D2=ASC(DAT\$(X+1,X+1))-48:BYTE=H EX(D1)\*16+HEX(D2) 80 IF PASS=2 THEN PUT #1,BYTE:NEXT X:R EAD CHKSUM:GOTO 50 90 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN TOTAL=TOTAL-1000 100 NEXT X: READ CHKSUM: IF TOTAL=CHKSUM THEN 50 THEN 50
110 GOTO 220
120 IF PEEK(195) <>6 THEN 220
130 IF PASS=0 THEN 170
140 IF NOT DSK THEN 160
150 PUT #1,224:PUT #1,2:PUT #1,225:PUT #1,2:PUT #1,2:PUT #1,2:PUT #1,2:PUT #1,2:PUT #1,2:PUT #1,2:PUT #1,2:PUT #1,4:RN 160 FOR X=1 TO 89:PUT #1,0:NEXT X:CLOS E #1:END 170 IF NOT DSK THEN 200 180 ? "INSERT DISK WITH DOS, PRESS RET URN";:DIM IN\$(1):INPUT IN\$:OPEN #1,8,0 URN";:DIM IN\$(1):INPUT IN\$:OPEN #1,8,0
,"D:AUTORUN.5YS"

190 PUT #1,255:PUT #1,255:PUT #1,0:PUT #1,32:PUT #1,254:PUT #1,47:GOTO 210
200 ? "READY CASSETTE AND PRESS RETURN
";:OPEN #1,8,128,"C:":RESTORE 230:FOR
X=1 TO 40:READ N:PUT #1,N:MEXT X
210 ? :? "MRITING FILE":PASS=2:LINE=99
0:RESTORE 1000:TRAP 120:GOTO 50
220 ? "BAD DATA: LINE ";LINE:END
230 DATA 0,33,216,31,255,31,169,0,141,47,2,169,60,141,2,211,169,0,141,231,2,133,14,169,56,141,232,2
240 DATA 133,15,169,187,133,10,169,47,133,11,24,96 1000 DATA 0000000000000000000000007B32 32320000000060A0A020007E42427E42420000 003C7E7E7E3C000000007EFF,6 1060 DATA FFFF0000000003C7E7E0000000 000018300000000000001800000000000000 FFF7E000000007E7E3C0000000003C180000
0000000180000000000000,307
1088 DATA 00181818183C7E5A1818183C7EFF
DB000000000000000000042424242427E0000
001818001818000842424242,227
1090 DATA 241800007E5A5A42424240000464C
78584C4600FFFFFFFFFFFFFFFFFFF7E4242004242
7E0002020200020202003E02,923
1100 DATA 023C40407C003E02023C02023E00
4242423C02022007C40403C02023E007C4040
3C42427E003E020202002022,713
1110 DATA 007E42423C42427E007E42423C02
023E00706700202727272727272727272727 FFFF7E00000007E7E3C00000000003C180000 1120 DATA 462F1446B0130606462F1446DF13 463E14462F1446EF13467A14462F1446FF1346 900F000F000F000F000F000F000F000F000F00 0F000F000F000F000F000F00,218 1150 DATA 0F000F000F000F000F000F000F00 0F000F000F7030C700083042,329

1170 DATA 1115415A12187E7EFFFF7E7E1800 0000555500000015030C030B1308FF24330308 03150A0C06FF444D4E465846,960 1180 DATA 4C4F58FF618E838486808A8C8098 0F0A130C18C0C0CFF1968075,44 1210 DATA 00534D4F4A534C71408B86878F80 75750058464B46444F71CECAC8C9CFC0757500 584F434E4F7100000D0B0311,159 1220 DATA 0075000F0E0A0808060E31000000 000075750085868C988A8F91B1808000000075 750098898A8D98B100000000,183 1230 DATA 0000007575008493B3868F98B100 000000000757500B08C8AB2868E9886B10000 00007575000000000000000,320 1240 DATA 000000000007500000000CCD3C0 C6C7C7C6C4CFC075000000000000D8C9CAC6CB C5D8C0750000000000F3CAD8,953 1250 DATA D8CACBC6D8C075000000D0C3CECD C0C5CECAF2C6C0750000000000D8CFC3CCC5C3 CEC5C07500000000000000C5,780 1260 DATA D3F0DBCBC6C0750000000000000 CFCECACDCBC6C0750000000000000B8F0CD C6CEC075000000000000CED3,481 1270 DATA C4F4C6CFD8C075000000000000000 C3F0C4C6CED8C075000000000C5CAD8C3DBCB C6C5C075000000000000C6CC,965 1280 DATA C3DBCBC6C5C07500000000000CDD3 D8CACFCAF2C6C075000000000CCC6C8C3CFCA F2C6007500000000004130D11,94 1290 DATA 0E0A08090F001200030C030B1308 0033030803150A0C0600141C1B170000000000 001313000000F9F1F6F6E4F6,930 1300 DATA 00000013130000030000000000F1E 1A181D1B333530FCF303000301010101030003 02030202030200000000000000,842 1310 DATA 34123D1246124F122B123E144D14 5C146B147A1489149814A714B614C514D414E3 14F214011503030101010004,508 1320 DATA 04020200183C3C185A7E5A420018 7EDB7E0000000000B66DDBB61020010258A003 115030C434003C7E7EFFFFF,15 1330 DATA FFFFFF7E7E3C00C646F666266CA2 51404848E683A5140A29CE8DC2026840AD1FD0 314040406003H3140H27CE0DC2620049HD1FD6 48458225828482C904608D02,265 1340 DATA D2A9A48D03D2A0C0CAD0FD864D88 D0F88C03D260A200A9A48D01D28D03D2A912C5 83D0FC20EB15D00568684CA4,554 1350 DATA 17A9008583E88A8D03D029FC8D02 D04A4A4A8B971139939218A0A0A0A0A0A49F0 8D00D21869028D02D28AD0C4,204 1360 DATA 8D03D2858560A207A9009D00D0CA 10FA60A9008D01D28D03D28D05D28D07D260A9 3C8D02D3A92B8580A9128581,377 1370 DATA A9008D08D2A2559582CA10FBA929 8D2F02A9038D0FD2A9398D07D4A9028D1DD0A9 DE8D0002A9158D0102A9C08D,343 1380 DATA 0ED4A9108DF402A9C68DC502A994 8DC602A9048DC302A9018D0AD08D0BD08D6F02 205A1685A18586206516AA9D,347 1390 DATA 00209D00219D00229D003BCAD0F1 A207BD0A139D283BBD02139DA83BCA10F1E8BD 1213F010A8E8BD1213C9FFF0,359 1400 DATA F1990021C84C0117A9008D3002A9 128D3102A9208D0312A9008D0212854D8585A9 102483F0FC20EB15D0034CA4,577 1410 DATA 17A9008583E684A584186D021245 868D00D2A584290769DD8D06228D092269088D 868D00DZA564Z70767DD00D02Z20D07Z20700D 16228D1922A584C910D03BA9,895 1420 DATA 0085848D05D4E685A58645850980 8D01D2AD02121869108D0212901EEE0312A922 CD0312D0034C8D16200E16A9,919 1430 DATA 208000D2A98F8D01D2A90F8586A5 848D05D44C2817A583C583F0FCA9218D2F02A9 158D3002A9128D310220281F,582 1440 DATA 205A16854D8D1D0020651685A085 A1A9948DC602A9048592A692BDD4158DC502BD D91520F815C69210EEADFC02,993 1450 DATA 293FA209DD5115F005CAD0F8F01D 8A8D4D151869938DAE138A69F68D4015A9FF8D FC028A0A0A493F20F81520EB,146

1460 DATA 154A99034CA01D4A99024A93020F8
15A687F689B5893D99159589058E0AAAA000BD
7D159180C8BD7E1591804CE6,158
1470 DATA 174A909FA91020F815A2018688A5
870A0A0AAAA00DA9805DE0139DE013E88810
F4A588D0034CE617E687A587,327
1480 DATA 0AAABD71158580BD72158581A687
BD9E15658E858EA200A587C905D0C18687868E
4C4E18A9008593A8A92C8594,767
1490 DATA A906859160A902858FEC0AD22690
069006900690C68FD0F1A59091936020941806
91A68A20A218C8D0FAE694C6,449
1500 DATA 91D0F4C694A906859188B1934A91
9398D0F7C694C691D0F160A00A99000A99800A
8810F7BDBE1595D49D00D08A,799
1510 DATA 48BDC015AAFE0008BD0008C91D90
08A9139D0008FEFF0768AABDC2158D04D2A9AE
8D05D2A90385B5D6AED004A9,140
1520 DATA 0085ADA9FF8D1ED0608A48A5836A
B02EC6B41004A90285B4A6BB4BDB6158DAF1529
3C8DA515BDB715293C8DA615,386
05C6B54C7B198D05D2C0C08,897
1540 DATA A583290EAABD5D158D6E15BD5E15
8D6F1568AA60CE1808105BA905BD1808A9698D17
08A5B5D00AA9A48D05D2A9408D04D2CE0A08CE
16081022A9FF8D0A08A9998D,404
1550 DATA 1608CE0908CE15081010A9FB8D09
08A9058D1508CE0708CE140808A5B5505CB05CC
D01BA5A825A9F015A5B765B8,644
1560 DATA F00FA9288D05D2A5834A29070908
8D04D22860AD09D02901D010AD04D029040D0C
D0F00AA5B0C901F004A990085A960B5B7D0FB
8D0C902F00395B260D5B2F0,822
1580 DATA A8AD08D02902D010AD05D029040D0
DD0F00AA5B0C901F004A990085A960B5B7D0FB
85B0C902F00395B260D5B2F0,822
1580 DATA EE95B295B718B5D4690285CD
D5D685D0E6D095BFF6BF8AF900BA5D4690285CC
D5D685D0E6D095BFF6BF8AF90BA5D4690285CC
D5D685D0E6D095BFF6BF8AF90BA5D4690285CC
D5D685D0E6D095BFF6BF8AF90BA5D4690285CC
D5D685D0E6D095BFF6BF8AF90BA5D4690285CC
D5D685D0E6D095BFF6BF8AF90BA5D4690285CC
D5D64C601AA5D5690285CDA5,658

# **CONTEST!**

Here's a little contest that should keep all the code-crackers out there occupied.

The numbers below, when decoded, are a message in standard Atari ASCII. The numbers are in the proper sequence, and have been encrypted using a simple algorithm.

```
145 211 145 185 255 186 112 88 183 174 224 34 145 126 226 178 51 207 191 129 188 234 4 191 199 175 178 243 197 16 118 43 210 198 166 241 237 194 211 94 213 171 252 246 233 178 12 218 210 203 172 129 133 219 23 186 206 170 203 141 126 246 117 203 190 250 212 206 22 160 197 161 182 183 246 20 53 141
```

Decode the message, if you can, and send your solution to:

Code-Cracker Contest c/o ANALOG Computing P.O. Box 23 Worcester, MA 01603

The first five entries we receive with the correct solution will win a *free one-year cassette* or disk subscription. All entries must be postmarked before January 1, 1985.

```
1590 DATA D785CEE6CEA90195C195C938A5CE
E5D095BBB00AA9FF95C155BB95BBF6BB38A5CD
E5CF95C5B00AA9FF95C955C5,153
1600 DATA 95C5F6C5A90095C395B9B5C595BD
A90F95CBB5BBD5BD900695BD4A95C360B5BD4A
 9589604820EB19202D19E683,514
1610 DATA 18A5AC693085AC8D02D2A5ADD003
 4C611CA9088D17D08A48A20FA5A8D0038E7802
A5A9D0038E7902AD78022D79,451
1620 DATA 02C90FA981B00CA5B00581C903A9
 88B002A9848D07D2A918B002A9208D06D2A200
86B6E8AD08D085D2AD09D085,918
1630 DATA D3A5B005B1C901D00FAD0AD2291F
09208D06D2A9A68D07D220E11CB5A8F034B5B0
C901F02E20221AA5836A9006,48
1640 DATA B5B0C903D0205E7802B002D6D65E
  7802B002F6D6A58BF00E5E7802B002D6D45E78
 028002F6D4B5D4C930B002A9,744
1650 DATA 30C9C89002A9C795D49D00D08492
 B5A83024A5836AB01D0A29F69DC002A5B5D013
 A583290709C88D05D2AD0AD2,274
1660 DATA 291F09208D04D2F6D6B5D6D00320
E318C9C0902BB5A8D025B5D4DDBE15F00AF6D4
E318C9C0902BB5A8D025B5D4DDBE15F00AF6D4
901AD6D4D6D4D014A9FF95A8,789
1670 DATA 8D1ED0BDC4159DC002A5B5D0038D
05D2A9BF95D6E0016A859B9007A5B61DBA1585
B68A4818B5A8F019AD0AD229,511
1680 DATA 0F1DC4159DC002B5B0C90138F007
18BDC4159DC002A009A209A58BF002A212BDA3
1590032D0AD2919BCA8810F2,513
1690 DATA 68AAB5B7F006A001A900919BA492
CA30034C2B1BA5B68D1CD0A5ADF01320651910
  1CA9F68D07088D09088D0A08,14
  1700 DATA 8D0C08A979854DA90085AD8D05D2
 8D07D268AAA5A42583F0026840A5AAF0FA9848
 8A48A5A225A7D009A5A51865,640
 1710 DATA A6297F85A5A00DA6A5AD0AD239C6
159D000BAD0AD239C6159D800BE88A297FAA88
19F000BBD0AD239C6159D80BE88A297FAA88
10E6AD0AD229F009048DC202,692
1720 DATA AD0AD229F009088DC30218A5A265
A385A28D02D08D03D085AAE6ABA5ADF011A5AB
C97DB00E4A4A8D00D2C91890,353
1730 DATA 05499F8D01D268AA68A86840BD84
024AB002A58935A8D5B0F0038D1ED095B0B5B7
024AB002A58935A8D5B0F0038D1ED095B0B5B7
F006B5BFD00395B76018B5BB,103
1740 DATA 75B995B9D5BD900BF5BD95B918B5
C175BF95BF18B5C575C395C3D5BD900BF5BD95
C318B5C975C795C7B5CBF012,215
1750 DATA 4A09888D05D2B5CB490F0A0A0A8D
04D2D6CBB5C79D04D0B5BF4A900948A5B61DBC
1585B6680980859DB5D23D71,480
1760 DATA 15D022B5C7F01E9848A003B19D3D
5B1585D1B96D15E001D0020A0A05D1919D8810
E968A860A90095B79848A0003,556
1770 DATA B19D3D5B15919D8810F6B5D23D71
15F00320F61868A8602965168D1ED0A9FF85A8
 15F00320F61868A8602065168D1ED0A9FF85A8
 85A9A9408D0ED4A90C8591A9,51
1780 DATA 008593A9208594A909859EA9218D
6F028D06D2A9018D0AD08D0BD085ADA96385AE
85AFA218BD39159D0008CA10,9
1790 DATA F7A96A859C20281FA9058D0CD0A9
0085A285A085AA854D85B585B785B8A89193C8
D0FBE694C691D0F5A9BF85D6,579
1800 DATA 85D79899800999000A99000BC8D0
F420BA18A201BDBE159D00D095D4CA10F5E88E
C6028690A92E8D2F028DC502,939
1810 DATA A9088D07D4A9038D1DD0A9C48DC0
 02A9348DC102A9B08D0002A91A8D0102A95A8D
02A9348DC102A9B08D0002A91A8D0102A95A8D
3002A9128D3102A9C08D0ED4,667
1820 DATA 20941866909007B1930980189002
B1936A9193C8D0F8E694C691D0F2A9068591A9
008593A937859488B1932A91,502
1830 DATA 9398D0F7C694C691D0F126908595
85978593A9328596A92C8598A9208594A9EC85
99A91F859AA24CA013B19511,842
1840 DATA 97919391998810F5A59518691485
9585979004E696E69818A593692885939002E6
9418A599692885999007F694.507
 9418A599692885999002E69A,507
1850 DATA CADOCB20EB1590634CA4176A9003
4CA01DA58DF04EA5A0F033202D1FC69FA5ADF0
05A59F4A09A08D03D2A59FF0,109
1860 DATA 300A0A0A49FF85ACD02CA5A16A90
0FA204A90F5DC4029DC402CA10F5C6A160AD0A
D2293FD010202D1FA91F859F,898
1870 DATA 85A0D00585A08D03D2A58CF004A5
AAF0034C6A1EAD0AD2293FD0F685A4AA9D000B
 CADOFA8D02D08D03D085ABAD,816
```

# CHECKSUM DATA.

(see page 90)

10 DATA 551,351,496,811,423,729,200,60
3,555,573,694,613,29,205,227,7060
160 DATA 773,198,962,638,491,30,155,10
5,309,55,181,206,334,77,966,5480
1060 DATA 760,927,68,666,80,109,432,21
6,301,300,274,480,171,97,546,5427
1210 DATA 698,173,54,544,895,622,754,1
6,149,907,268,802,994,991,727,8594
1360 DATA 966,902,865,957,640,603,511,762,944,24,809,859,907,684,806,11239
1510 DATA 46,984,937,909,847,4,921,240,546,122,58,873,948,912,843,9190
1660 DATA 104,69,785,912,950,11,983,91
3,244,72,771,121,924,234,9,7102
1810 DATA 946,608,910,613,58,50,961,29,909,773,5857

# Listing 2. Assembly listing.

```
AUDCTL = $D288

SKCTL = $D29F

RANDOM = $D29F

STRIB = $0284

STRIB = $0284

STRICK = $0278

PABES = $06

P8PF = $D605

P8PF = $D605

P8PL = $
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       laudio control
Iserial ctrl
Irandom number
Ijoystick trig 9
Ijoystick 8
Iscrn block size
IPB/PF collision
IPB/PL collision
IMB/PL collision
IPB/PL collision
IPB/PL collision
IPB/PL collision
IPB/PL collision
IPB/PL collision
ICCOLLISION
ICCOLLISI
                               Page Zero equates
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       *= $80
                    TY E N TE P CF FD MS EX E R MC CSCRLWLW PACKERS OF TRACERS OF TRAC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | menu select pnt | console save | c
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   #= ORIGIN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  The definition of the control of the
                                                              Redefined Character Set Data
```

	. BYTE #, *7F, *9F, *7F, *66, *66, *66, *68  BYTE #FF, *FF, *FF, *FF, *FF, *FF, *FF, *FF,	Intro	duction.	Title Data	LADR MADR	.WORD DOD, DOB, DOC, DOU, DOT .WORD TOPT, TOPT2, TOPT3, TOPT4 .WORD DOPT, DOPT2, DOPT3, DOPT4 .WORD SOPT, SOPT2, COPT .WORD COPT2, UOPT, UOPT2
	.BYTE 97E, 66, 66, 9, 66, 66, 97E, 9 BYTE 62, 2, 2, 68, 64, 64, 97C, 9 BYTE 62, 2, 2, 68, 64, 64, 97C, 9 BYTE 66, 66, 68, 2, 2, 2, 2, 2, 8 BYTE 66, 66, 66, 68, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,		BYTE BYTE BYTE BYTE	1 OC, 8C, 9FF, 36, MC 1 AC, 9C, AC, NgC+2, IC 1 NC, EC, 8FF, 48 1 +840, EC, NC, TC, 8C 1 +840, EC, NC, TC, 8C 1 +8FF, 47	SELMSK SELMS2 SHIPS	WORD COPT2   OOPT2     BYTE 3, 4, 1, 2, 2     BYTE 3, 4, 1, 2, 2     BYTE 8, 41, 2, 2, 3, 4, 2     BYTE 8, 41, 2, 2, 3, 4, 3, 4     BYTE 8, 41, 20, 3, 4, 3, 4     BYTE 8, 41, 20, 3, 4, 3, 4     BYTE 8, 41, 20, 3, 4, 3, 4     BYTE 9, 41, 3, 4     BYTE 3, 41, 41, 41, 41, 41, 41, 41, 41, 41, 41
1	BYTE \$7£,02,02,02,03,00,00,00,00,00,00,00,00,00,00,00,00,		BYTE BYTE BYTE BYTE	+980, IC, NC, 0, 5C, PC +980, AC, CC, EC TMC, TMC+1, FFF, 131 +940, WC, RC, IC, TC, TC, EC	ROTMSK VDMSK XSTRT SCPNT	BYTE \$B6, \$6D, \$DB, \$B6 BYTE \$10, \$20, \$01, \$02 BYTE \$0, 160 BYTE \$17
Intro	duction Display List		. BYTE	+ + 4 4 0 NC, 0 , BC , YC - + + C	PCOLRS COMETM	.BYTE \$59,\$39 .BYTE \$C4,\$34 .BYTE #0.\$3C.\$7E.\$7E
ĎISPI DADR	.BYTE \$78,867 .WORD DRAM .BYTE \$27,827,\$27, .BYTE \$27,827,\$27		BYTE BYTE BYTE BYTE	+\$C#,8C,#,#BC,AC,CC +\$C#,HC,AC,NC,DC +\$FF197,CRC,# NBC-11,NBC+9,N#C+8	CE3KN	BYTE SFF, SFF, SFF, SFF BYTE SFF, S7E, 37E, 35G BYTE \$66, \$46, \$F6, \$66, \$26 BYTE \$6C, \$82, \$51, \$48, \$48
	BYTE \$27, \$47, \$41+DL1 .WORD DISPI		. BYTE	++88,8HC,0,8,8HC	DLI Ro	outine
Same !	Options Display List		. BYTE	+#40,8HC+1,0,0,8HC+1	DLIVEC	PHA
DISPO	.BYTE \$79.\$79.\$79.\$46	PRESS	OPTION	Hessage Data		LDA RTCLOK jaystem clock ASL A jtimes 2
	.WORD OPTASS BYTE \$87,\$46 .WORD SB .BYTE \$46	PMSS	. BYTE	# # # # # # # # # # # # # # # # # # #		AND #SCE   mask color STA PCDLR2   saucer color PLA   prestore Acc RTI   prestore   pres
	.WURD UL1 .BYTE \$#6,\$#6,\$46	1	BYTE	0,0,6,0,6,6,6,0,0	Consol	e Checker
	BYTE \$46 -WORD OL2	Option	s Scre	en Data	CONC	LDA CONSOL   get console TAY   fo Y register
DOT	BYTE \$46 WORD TOPT BYTE \$46 WORD 8B BYTE \$46	ÖPTMSB	.BYTE .BYTE .BYTE	STATE   STAT		LDA CONSOL   jet console   jet y register   jet y registe
DOD	.WORD OL3 .BYTE \$46	TIMOPT	. BYTE	+\$C0,9,0,TC,COLC +\$80,N0C+3,0	!	RIS Ireturn
DOD	.WORD DOPT .BYTE \$46 .WORD 8B	OL1	.BYTE	: BX, 0 : +\$40,0C,PC,TC,IC : +\$40,0C,NC,COLC,0	Beep F	Coutine
	.BYTE \$46 .WORD OL4		. BYTE	+680'LC'EC'FC,TC',#	BUZZER	STA AUDF2   buzzer freq LDA ##A4   pure tone STA AUDC2   in tone 2
DOS	.BYTE \$46 .WORD SOPT .BYTE \$46 .WORD SB		. BYTE	: +440,8C,EC,LC,EC,CC : +440,TC,COLC : +460,RC,TC,RC,HC,TC,M	n z	LDY ##C#   beep counter
	.BYTE \$46		. BYTE	8X,8X,0 +\$40,8C,TC,AC,RC,TC		BNE BZ   izero yet? No. BTX ATRACT   noke attract
DOC	.WORD OL5 .BYTE \$46 .WORD COPT	0L2	. BYTE	+ \$40 COLC 6 6 PC LC AC YC 8 8 4 PC LC AC YC 8		DEY   decrement Y BNE BZ   stone done? No. BTY AUDC2   Yes. turn off
	.WORD COPT .BYTE \$46 .WORD SB	0F2	. BYTE	RC,COLC,0,0,0,0,0,8x	!	RTS
	.BYTE \$46 .WORD OL6 .BYTE \$46		.BYTE	: +\$80,DC,EC,NC,8C,IC,TC : +\$80,YC,COLC,0,0	Flying	Saucer Routine
מסמ	.WORD UOPT .BYTE \$46	OL4	. BYTE	81.0 +*80,5C,HC,IC,PC,SC	DELAY	LDX ##   lget zero LDA #\$A4   lpure tone STA AUDC1   lenable tone 1
	.WORD SB .BYTE \$46 .WORD OPTMSB .BYTE \$41	0L5	.BYTE	. +\$80,000 . 0,0,0,0,0,0,0,0 . BX.0	DL1	STA AUDC2   senable tone 2
	BYTE \$41 .WORD DISPO		. BYTE	+#80,CC,OC,MC,EC,TC +#80,SC,COLC	DL2	CMP CLOCK
Bane i	.WORD DISPO Playfield Display List	014	. BYTE	BX.0 + + + 880.UC.NC.IC.VC		BNE DL3   OPTION key? No. PLA   Yes. oull RTS
DISPE	.BYTE \$70,\$70,\$70,\$4F .WORD DRAM	88	.BYTE	+\$80,EC,RC,SC,EC,COLC	ד ומ	PLA Jaddr From stack JMP STOPTS Joptions menu LDA #8 Joet zero STA CLOCK Jinit clock
	MORD DRAM DBYTE 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15 DBYTE 15, 15, 15 DBYTE 15, 15, 15, 15 DBYTE 15, 15, 15 DBYTE 15, 15, 15, 15 DBYTE 15, 15 DB	TOPT	.BYTE	6 à 4 à 4 à 4 à 7 à 7 à 7 à 7 à 7 à 7 à 7	200	STA CLOCK   Init clock   INX   linc saucer pos
	.DBYTE 15,15,15,15,15,15,15 .DBYTE 15,15,15,15,15,15,15 .DBYTE 15,15,15,15,15,15	TOPT2	.BYTE	+ + C0, NC, DC, 0, EC, FC, FC + + C0, EC, CC, TC, 0 Bx 0 0 0 0 0		INX Sinc saucer pos TXA Smove to Acc STA HPOSPS Smove saucer AND #SFC Swindow movement
	DBYTE 15, 15, 15, 15, 15, 15, 15 DBYTE 15, 15, 15, 15, 15, 15		. BYTE	+\$CØ,8C,AC,IC,EC +\$CØ,LC,DC,8C,Ø		AND #SFC Swindow movement STA HPOSP2 3do windows LSR A 3times 2 LSR A 3times 4
	DBYTE 15, 15, 15, 15, 15, 15, 15, 15, 15, 15,	TOPT3	.BYTE	+\$CØ, MC, 1C, 8C, 8C +\$CØ, IC, LC, EC, 8C, Ø		
	DBYTE 15,15,15,15,15 BYTE 870,430,847+DL1	TOPT4	. BYTE	BX,0,0,0 +\$C0,WC,AC,RC,PC,0 +\$C0,DC,PC,TC,UC,FC,0		LSR A Stimes STAY LDA PMSS,Y Squttext STA DRAM+313, Y Jon screen TXA ASL A Stimes 2 ASL A Stimes 2
	.WORD ANALOS	DOPT	. BYTE	8x,9,9,0,0,0 ++c9,5c,TC,AC,NC		ASL A Stimes 2
1	.BYTE \$41 .WORD DISPS	DOPT2	. BYTE	. ++C#,DC,MC,RC,DC,# . BX,0,#,#,#,#,#,# . ++C#,DC,OC,UC,BC,LC		ASL A Stimes B ASL A Stimes 16 ASL A Stimes 32 whem! EOR ##F## STA AUDF1 Saucer sound CLC Sclear carry ADC #2 STA AUDF2 Swird sound STA AUDF2 Staucer position
Flying	saucer in Intro Data	DOPT3	. BYTE	+ * C Ø E C Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø		EOR ##FØ   Jinverse hi bits STA AUDF1   Jsaucer sound CLC   Sclear carry ADC #2   Jweird sound
SAUCER	.BYTE \$18,\$7E,\$7E,\$FF .BYTE \$FF,\$7E,\$7E,\$18 .BYTE \$90,\$80,\$00,\$55 .BYTE \$55,\$00,\$00,\$60	DOPT4	. BYTE	++CØ,EC,Ø BX,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø		ADC #2   weird sound STA AUDF2   with resonance
WINDOW		SOPT	. BYTE	. ++c#,80,00,P0,E0,R0,# : BX,0,#,9,#,9,# : ++C#,R0,001C0.K0		TXA
Redefi	ned Char Set Equates	SOPT2	. BYTE	+\$CØ,EC,TC,8C,Ø BX,Ø,Ø,Ø,Ø,Ø,Ø +\$CØ,8C,AC,UC,CC,EC		STA VOLUME
TMC AC CC	= 1 = 3	COPT	BYTE	+\$CØ,RC,SC,Ø BX,Ø,Ø,Ø,Ø	Move A	All P/M Off Screen
DC:	- 4 - 5 - 6	COPT2	. BYTE	+ + + CØ, DC, 1C, SC, AC : + + CØ, BC, LC, EC, DC, Ø : BX, Ø, Ø, Ø, Ø, Ø, Ø	CLRPM	LDX #7 18 objects 0-7 LDA #0   zero position STA HPOSP0,X   sove P/M DEX   decrement count
EC FC 9C	- 6 - 7 - 8	UOPT	. BYTE	++CØ,EC,NC,AC,BC ++CØ,LC,EC,DC,Ø	CPM	STA HPOSPØ,X imove P/M DEX idecrement count BPL CPM idone? No.
HC ICC NCC PCC TC	- is - ii		.BYTE	+\$CØ,PC,OC,SC,IC +\$CØ,TC,IC,VC,EC.Ø	1	RTS
NC PC RC	- 12 - 13	UOPT2	. BYTE	#\$CØ,NC,EC,GC,AC,TC	Turn C	Off All Sound
MC	= 14 = 15 = 16	ANALDB	. BYTE	0,8X,0,0,CC,OC,PC,YC	AUDOFF	LDA ## :get zero STA AUDC1 :sound 1 off
YC CRC NØC	= 17 = 18 = 19		.BYTE	CRC.#,AC.NC.AC.LC CRC.#,AC.NC.AC.LC CC.BC.#,AC.AC.BC.AC		STA AUDC1   Bound 1 off STA AUDC2   Bound 2 off STA AUDC3   Bound 3 off STA AUDC4   Bound 4 off
BC OC SC	- N#C+8 - N#C - OC+5		. BYTE	NGC+2, IC NC, EC, 0, NGC+1 NGC+9, NGC+8, NGC+4	Progra	RTS Freturn  Am Execution Starts Here
SMK SMK2	= NØC+10 = SMK+8	TRAMI TRAMC	BYTE	0'0'N0C N0C 0 0 0 ++C0,N7C+3,COLC N7C	1	100 0070
SHC MT UC	= SHC+2 = MT+1	TRAMN	. BYTE	+ * CØ, N7C, SMK+7, N7C Ø, Ø, Ø, NØC, NØC, Ø, Ø	K12	LDA ##3C ;cassette off STA PACTL ;poke hardware LDA # <dot idensity="" lo<="" td=""></dot>
COLC VC MC	= UC+1 = COLC+1	NUMMSK	. BYTE	\$1F,\$1E,\$1A,\$19 \$1D,\$1B,\$33,\$35.\$39		STA PACTL   poke hardware LDA e CDT   density lo STA SELPNT   select point lo LDA e >DOT   density hi STA SELPNT+  iselect pot hi
BX BX	= VC+1 = MC+1 = KC+841	MISIMA	BYTE	9FC, 9F3 3,0,3,1,1,1,1,3		
N7C	= KC+2	MIMAGE	. BYTE	0,0,0,0,4,4,5,4 *#E,*#D	11	STA AUDCTL laudio control LDX #YPLR+1-CONSAV STA CONSAV,X lzero flags
				*		

```
LDA $$21 | value for STA SDMCTL | Inarrow playfid DA & OJISPO | Inarrow playfid LDA & OJISPO | Inarrow playfid LDA & OJISPO | Inarrow playfid LDA & DJISPO | Inarrow playfid LDA & DJISPO | Inarrow players | Inar
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         CPX RANDOM | with density ROL TEMP+1 | carry to bit Ø ASL TEMP+1 | to bit 1 | ASL TEMP+1 | to bit 2 | ASL TEMP+1 | to bit 3 | DEC TEMP | inibble count BNE RANWØ | byte done? No. LDA TEMP+1 | move byte to STA (GRPAGE) | Y | graphic area RTS
                                                                                                                                                                                                        DEX
BPL II
                                                                                                                                                                                                                                                                                                                                                                                                                                                                               idecrement index idone? No.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     RANMO
       System Reset Returns Here
                                                                                                                                                                                        Reset Returns Here

LDA $29
STA SDMCTL | narrow playfld |
LDA $3 SKCTL | off | 2-tome mode |
LDA $3 SKCTL | off | 2-tome mode |
LDA $3 SKCTL | off | 2-tome mode |
LDA $3 SKCTL | off | 2-tome mode |
LDA $3 SKCTL | off | 2-tome mode |
LDA $4 SKCTL | off | 2-tome mode |
LDA $4 SKCTL | off | 2-tome mode |
LDA $4 SKCTL | off | 2-tome mode |
LDA $4 SKCTL | off | 2-tome mode |
LDA $4 SKCTL | off | 2-tome mode |
LDA $4 SLETT | DLI | vector |
LDA $4 SCLETT | off | off |
LDA $5 SCHARS | character |
LDA $6 SC | state | off |
LDA $7 STA LEPT | off | off |
LDA $7 STA LEPT |
LDA $7 STA LEPT | off |
LDA $7 STA LEPT |
LDA $7 STA LEPT | off |
LDA $7 STA LEPT |
LDA $7 STATE |
L
   INTRO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Fill Workspace With Graphics
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             JSR LDBRRT | init pointers | State | S
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             RANFIL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          STS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             RANFS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Shift ASTR Space To Right
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              8T1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DEC GRPAGE+1 | Idec page pntr
LDA #PAGES | get block count
STA TEMP+2 | store count
DEY | Idec index |
LDA (GRPAGE) | Y | lasteroid byte
LSR A | Force to odd
STA (GRPAGE) | Y | Ireplace byte
TYA | SNE RANF1 | SINDEX = 97 | No.
DEC GRPAGE+1 | Shack up pntr
DEC GRPAGE+1 | Shack up pntr
DEC TEMP+2 | Idecrement count
BNE RANF1 | Sone? No.
STA | Idecrement count
SNE RANF1 | Idecrement count
SNE 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              STIA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             RANE 1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          STIR
   12
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Ship Scoring Routine
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     LDY #19 | iclr top 16 bytes
STA PMB, Y | iof player 9
STA PMB, Y | iof player 10
STA STA STA HPOSPB, X | set reposition
STA TAA | ist oplayed pose
STA TAA | ist oplayed pose
STA TAM, X | ist oplayed pose
INC TRAM, X | ist oplayed pose
INC TRAM, X | ist oplayed pose
INC STA TAM, X | increment score
LDA TAM, X | increment score
INC STA TAM, 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SCORE
SCØ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          STIC
   Print Text Onto Display
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          SELECT Key Handler
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SCOREM
                                                                                                                                                                                                    INX
LDA TITLE, X jget text
BEQ STITL | Syte zero? Yes.
TAY | display index
INX | inc text index
LDA TITLE, X lget text
CMP ##FF | BEOL flag
BEQ PTITL | BEOL? Yes.
STA DRAM+256, Y jon screen
INY
JMP P2 | inc displa indx
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      LSR A SELECT Key? No.
LDA #838 SELECT Key? No.
LDA #838 SELECT Key? No.
LDA BESS SELECT Key? No.
LDA TRIB, X SELECT Set No.
LDA TRIB, X SELECT Option byte
LDA TRIB, X SELECT Option byte
MAD SELMSK, X SEA Option byte
LDA TRIB, X SELECT Option byte
LDA TRIB, X SELECT Option byte
LDA MADR, X SELECT Option
LDA MADR, X SELECT Option byte
LDA MADR, X SELECT MARKET SELECT
LDA MADR, X SELECT MARKET SELECT
LDA MADR, X SELECT MEY OPTION
LDA TRIB, X SELECT MEY, No.
LDA MADR, X SELECT MEY, No.
LDA MADR, X SELECT MEY, No.
LDA TRIB, X SELECT
LDA TRI
   PTITL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              ST2
   P2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             801
                                                                                                                                                                                            Text For Intro

LDA & <DISPI | DL addr lo
LDA & >DISPI | DL pntr lo
LDA & >DRAM | screen top hi
STA DADR+1 | DL LMS hi
LDA & DADR | DL LMS lo
STA DADR | DL LMS lo
STA ATRACT | poke attract
STA VOLUME | Clear volume und
BTT CLOCK | check clock
BEQ S2 | time up? No.
JSR CONC | console keys
BET STA POLITIC | console keys
BET CONC | console keys
BET STA DOLL | console keys
BET CONC | console keys
BET STA POLITIC | console keys
BET STA DOLL | console keys
| cole keys
| cole keys
| cole keys
| cole keys
| co
       Scroll Text For Intro
   STITL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          OPTION Key Handler
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             802
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   LSR A
BCC STI
LDA #$10
JSR BUIZER
STA
LDA #$10
LDA #$10
LDA WITCH
LDA DPTION
ASL A
ASL A
ASL A
LDY #13
LDA #$10
LDA #$10
LDA #13
LDA #$10
LDA #$10
LDA #$10
LDA #$10
LDA DPTION
STA DL2+1, X
LDA #$10
LDA DPTSW
LDA DPTS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              ST3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     Ship Graphics Rotation
   S1
S2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         TXA
PHA
Save X
LDA CLOCK
ROR A
Steet bit 6
BCS R12
DEC ROTATE
DEC ROTATE
LDA #2
STA ROTATE
LDA ROTHEK
LDA LOCK
STA SHIPS+3
LDA CLOCK
STA SHIPS+3
LDA LOCK
STA SHIPS+3
LDA CLOCK
STA SHIPS+3
LDA LOCK
STA SHIPS+3
LOCK LOWE

TAX
STA MIMABE+1
LDA MISIMA+1
STA MIMABE+2
LDA MISIMA+1
STA MIMABE+2
IImage buffer+1
LDA MISIMA+1
STA MIMABE+2
IImage buffer+1
LDA LOCK
ITERET

TAX
ITERET

OWN TIMET HANDLET

ONN TIMET HANDLET

ONN TIMET HANDLET

ONN TIMET

TAX
STA SHIPS+3
ITERET

ONN TIMET

ONN TIMET

TAX
STA SHIPS+3
ITERET

TAX
STA SHIPS+3
ITERET

TAX
STA SHIPS+3
ITERET

TAX
STA SHIPS+3
ITERET

TOCKET

STA SHIPS+3
ITERET

STOR

TOCKET

STA SHIPS+3
ITERET

TOCKET

TOCKE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ROTOR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          814
82A
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      STAA
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             RT1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      STAB
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RT2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         Countdown Timer Handler
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         DEC TRAM+24 | 1/10 sec timer
BPL TMX | time up? No.
LDA 85 | yes. value to
BTA TRAM+24 | reset timer
LDA SCLOCK | tic sound clock
BEQ RT3 | tic done? Yes.
JMP RT4 | continue
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     TIMER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Asteroid Field Initializer
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     STA AUDC3 | tic sound off
DEC TRAM+12 | 1/10 sec displa
DEC TRAM+23 | 1/10 sec cntr
BPL TMX | 1 sec done? No.
LDA #N7C+$CP | value to reset
STA TRAM+23 | 1/10 sec cntr
LDA 89 | 1/10 sec cntr
LDA 85CLOCK | sound clock | sound c
   84
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             Initialize pointers
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          LDA * (ASTR | asteroid right STA GRPAGE | field addr lo TAY | LDA * ASTR | asteroid right STA GRPAGE+1 | field addr hi LDA * PABES | if of 256 byte STA TEMP+2 | blocks to move ITS | |
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LDBRRT
   83
                                       Same Option Menu Routine
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Generate Asteroid Field Bytes
   STOPTS
                                                                                                                                                                                                    LDA CLOCK
CMP CLOCK
BED STP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   sallow one VBLANK
speriod to go by
spefore start
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              RANWRD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             ## 4-bit nibbles
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              LDA #2
BTA TEMP
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	BPL TMX 110 sec up? No.		STA ROWAC.	X   Y accumulator	MOULE	STA AUDF3 INC YPLR, X LDA YPLR, X SHE MOVEXA JSR SCORE SINCE MOVEXA JSR SCORE INCREMENT SCORE SINCE MOVEXA SHE MOVXA SHE MOVXA INC XPLR, X SHE MOVXA INC XPLR INC
	STA TRAM+10 tone's display		STA ENDPT.	K ; line length	HOVX4	LDA YPLR.X Iship Y coord
	LDA #9   svalue to reset		LDA ###F	linit value for		BNE MOVER6   screen top? No.
	BTA TRAM+22 lone's counter DEC TRAM+9 lten's display		LDA DELTAR	, x idraw iteration X inet delta Y	MOUEYA	JBR SCORE   Increment score
	DEC TRAM+21   ten's counter		CMP ENDPT,	k ibigger than	HOVENO	BCC MOVEXS INc. skip next
	BPL TMX   sminute up? No.		STA ENDET	idelta X7 No. K istore new value		LDA DEAD X Iship status
	STA TRAM+9   ten's display		LSR A	idelta Y / 2		LDA XPLR, X   ship X coord
	LDA #5   Ivalue to reset		RTS COLAC,	X IX coord Acc Ireturn		CMP XSTRT, X   compare w/start
	DEC TRAM+7   minute display	1				INC XPLR, X Imove ship right
TMX	DEC TRAM+20 iminute counter	4182	LBR A	idivide by 2		DEC MOVX6   lock? Yes, else
*****	LDA SCLOCK   if score sound		STA ROWAC,	X IY coord Acc		DEC XPLR X Imove ship left
	ORA COUNTR for missile 9/1		KIB	3 return	MAYUAM	IDA #8FF Ivalue for
	BNE TMXX   Yes. skip next	Game	Interrupt Se	rvice Routine		STA DEAD, X I working ship
	LDA DEAD   seither ship 0					STA HITCLE   clr collisions
	BEQ TMXX     dead? Yes.	ĞISR	PHA	I save Acc		STA PCOLRØ, X Iship color
	LDA MISSLE JOR flags for		JSR SHASH	lanimate shine		LDA SCLOCK Iscore and clock
	BEQ TMXX Jany active? No.		INC CLOCK	lincrement clock		STA AUDC3   zero sound
	LDA ##28 Iprojectile and		CLC I DA IINTUR	iclear carry	MDVX6	LDA #191   Ivalue for
	LDA CLOCK 160 cvcle clock		ADC ##3#	ichange sound	HUVEXO	CPX #1   ship 1?
	LSR A     make 30 cycles		STA UNIVS	ireplace sound		ROR A !carry=1 if Yes.
	DRA #8 19.15		LDA ENDBAM	lgame end flag		BCC MOVEX7   coord even? Yes.
TMXX	STA AUDF3   boomerang sound		BNE BI7	igame over? No.		LDA VDEL Svertical delay
IHAA	RTS ireturn	1		, 4.10 12 110		STA VDEL   Inew V.delay
Collin	alas Handler	Ship	Noise Genera	tion	MOVEX7	TXA
	PION HANGIEF	i				CLC
	184 M481 4-111- 4 4-	817	EDA #8	imedium grey		LDA DEAD, X Jahip status
SHASH	AND #1 Inlayer 6 ship		TXA	smove X to Acc		LDA RANDOM trandom number
	BNE HITP#   collision? Yes.		PHA LDY MIR	imave X		AND ###F !make #15
	AND #4 inlayfield 2 or		LDA DEAD	iplayer 8 status		STA PCOLRS.X Inew ship color
	DRA POPL Ito any player		BNE GI76	idead? No.		LDA TRIGN, X scheck trigger
	LDA TRIBN Itrigaer oction	8170	LDA DEAD+1	iplayer 1 status		SEC   set carry
	CMP #1   shield in use?		BNE GI71	idead? No.		BEQ MOVX7A ishields? Yes.
HITPS	LDA ## Ivalue for thin	G171	LDA STICK	Icheck if either		LDA PCOLRS.X ishin color
	STA DEAD   being shot down	737	AND STICK+	l istick pushed by	Mai	BTA PCOLR#, X   set color
PLRI	AND #2 Inlayer 1 shin		LDA ##81	rumble noise	MOVX7A	LDY #9   Ido 10 bytes
	BNE HITP1   collision? Yes.		BC8 GI63	both 15? Yes.		LDA SHIP   get ship type
	AND #4 inlayfield 2 or		DRA TRIBN+	1 Strigger opt 1		BER MOVEXD Frocket? Yes.
	DRA PIPL Ito any player		CMP #3	Iwarp speed test	MOVEXD	LDA SHIPS, X Iship graphic
	LDA TRIBN+1 Itriager ontion		BCS GI63	warp? Yes.		AND RANDOM ishields on? No.
	CMP #1   shield in use	0147	LDA #\$84	imed engine roar	MVXD	STA (BRPX), Y   put ship
HITP1	BER HITX lyes, ship safe	0193	LDA #24	iwarp frequency		DEX   graphic index
	STA DEAD+1   being shot down		BCS BI38	iwarp? Yes.		BPL MOVEXD   done? No.
HITX	RTS  return	8130	STA AUDF4	iset frequency		PLA spull X
Space	Boomerang Handler		LDX #6	init value for		LDA MISSLE, X   missile status
1			INX	smake X = 1		DEQ MVXDM   sactive? No.
MISFLY	LDA MISSLE, X ; missile status		LDA MOPL	imissile 0 to		LDA ## Ino shot graphic
	DA TRIGH Y stringer value		LDA MØPL+1	imissile 1 to	MUXDM	STA (BRPX), Y lput ship
	CMP #2   shots enabled		STA MOPLS+	1 PL collisions	114 4 2 11	DEX Inext ship
	BEQ MISF   Yes. continue		ORA TRIGN+	1 Itrigger opt 1		IMP MOVEX#   done? Yes.
	RTS		CMP #1	tcheck shields	MOVEX#	LDA VDEL IV.delay shadow
I Set u	n Launch Conrdinates		LDA RANDOM	trandom number		STA VDELAY   vertical delay
,			AND MAIE	ionly 631		CDH ENDONII JOHN DESCE
			HUD MATE	1 1 7 70 77		BEQ MOVXE2   game over? Yes.
NISE	CMP TRIBS Y LCORDAGE Shadow		DRA #\$2# STA AUDF4	sonly 3263		BEQ MOVXE2   jame over? Yes. JSR TIMER   decrement time
HISF	CMP TRIBS,X scompare shadow BEQ HITX   same? Yes.		DRA #\$2# STA AUDF4 LDA #\$A6	ionly 3263 ishield sound ivalue for		BEQ MOVXE2   game over? Yes. JSR TIMER   decrement time BPL BI9   time up? No. LDA #N7C+*C#   jzero graphic
MISF	CMP TRIBS,X ;compare shadow BEQ HITX ;same? Yes. STA TRIBS,X ;put shadow STA MISS!FX ; encole election	MOVE2	DRA ##2# STA AUDF4 LDA ##A6 STA AUDC4 JSR TRISR	Jonly 3263 Jehield sound Jvalue for Jehield volume Jread trigger		BEQ MOVXE2   jame over? Yes. JSR TIMER   jdecrement time BPL BI9   time up? No. LDA #N7C+*CØ   tree up? No. LDA #N7C+*CØ   tree up? STA TRAM+7   minutes display STA TRAM+9   time ar display
ÅISF	CMP TRIBS,X   compare shadow BEQ HITX   same? Yes. STA TRIBS,X   put shadow STA MISSLE,X   enable missile CLC	MOVE2	BTA AUDF4 LDA #\$A6 BTA AUDF4 LDA #\$A6 BTA TRIBR LDA DEAD,X	jonly 3263 sehield sound svalue for sehield volume sread trigger splayer status		BEQ MOVXE2   game over? Yes. JSR TIMER   decrement time BPL BIP   time up? No. LDA #N7C+\$CØ   zero graphic STA TRAM+7   minutes display STA TRAM+9   if seconds display STA TRAM+10   seconds display
MISF	CMP TRIBB, X   compare shadow BEQ HITX   same? Yes. STA TRIBB, X   put shadow STA MISBLE, X   enable missile CLC   clear carry LDA XPLR, X   ship x coord ADR APLR, X   ship x coord	MOVE2	STA AUDF4 LDA #\$A6 STA AUDC4 JSR TRIGR LDA DEAD, X BEQ MOVIGN	colly 3263   sahield sound   value for   sahield volume   read trigger   player status   Idead? Yes.   trigger value	MOUYES	BEQ MOVXE2   game over? Yes. JSR TIMER   decrement time BPL 819   time up? No. LDA %N7C+\$CØ   zero graphic STA TRAM+7   minutes display STA TRAM+19   10 sec display STA TRAM+10   1 sec display STA TRAM+12   1.1 sec display
<b>M</b> ISF	CMP TRIBB,X   compare shadow BEQ HITX     same? Yes.   sta TRIBS,X   put shadow STA MISSLE,X   put shadow STA MISSLE,X   put shadow   close	MOVE2	BTA AUDF4 LDA #\$A6 STA AUDC4 JDA TRIBR X BER MOVEX LDA TRIBR X LDA TRIBR X LDA TRIBR X LDA TRIBR X	ionlý 3263   shield sound   shield sound   value for   shield volume   read trigger   player status   dead? Yes.   strigger value   shields in use?	MOVXE2	BEQ MOVXE2   Game over? Yes. JSR TIMER   Idecrement time BPL GIP   Itime up? No. LDA %N7C+\$CØ   Izero graphic STA TRAM+7   Iminutes display STA TRAM+10   Iseconds display STA TRAM+12   Isec display STA TRAM+12   Isec display LDA %121   Igoto attract STA ATRACT   In 30 seconds
MISF	CMP TRIBB, X   compare shadow BEQ HITX   same? Yes. STA TRIBS, X   put shadow STA MISSLE, X   enable missile CLC	MOVE2	BTA AUDC4 LDA #\$A6 STA AUDC4 JSR TRIGR LDA DEAD BEQ MOVEX LDA TISN, CMP #1 BEQ MUSEX JSR MUSEX	ionly 3263 Ishield sound Ivalue for Ishield volume Iread trigger Iplayer status Idead? Yes. X trigger value Ishields in use? Iyes. skip next Ieove missile	MOVXE2	BEQ MOVXE2   Game over? Yes. JSR TIMER   Idecrement time BPL 819   time up? No. LDA %NTC+\$CØ   zero graphic BTA TRAM+7   minutes display BTA TRAM+9   10 sec display STA TRAM+10   seconds display STA TRAM+12   to display LDA 6121   to display
MISF	CMP TRIBB, X   compare shadow BEQ HITX   same? Yes STA HIRBS, X   put shadow STA MISBLE, X   lenable missile CLC   LDA XPLR, X   ship X coord ADC & 2   get ship center STA COLCRS, X   shot coord STA CLERRY X   ship Y coord	MOVE2	STA 4819 STA 4UD54 LDA 4UD54 STA AUD64 JSR TRIBR X LDA	inly 3263 Ishield sound Ivalue for Ishield volume Iread trigger Iplayer status Idead? Yes. X Strigger value Ishields in use? IYes. skip next Imove missile Iget clock value	MOVXE2	BEQ MOVXE2   Game over? Yes. JSR TIMER   Idecrement time BPL BIP   Idecrement time BIP   Idecr
ÅISF	CMP TRIBB, X   compare shadow BEQ HITX   same? Yes. STA TRIBBS X   put shadow STA MISSLE, X   put shadow STA MISSLE, X   enable missile CLC   loa xplr, x   ship x coord ADC &2 STA DLDCOL   X plot coord STA COLCRS, X   shot current X LDA yplr, x   ship y coord STA COLDROM   thip to coord INC OLDROM   ship top STA ROMCRS, X   shot current y	MOVE2	STA AUDF4 LDA AUDF4 STA AUDF4 STA AUDF4 JSR TRIGR, X DEQ DEAD, X DEQ TRIGN, BEQ MOVEX JSR MISFLY LDA CLOCK ROR A BCC MOVE2X	ionly 3263 ishield sound ivalue for ishield volume iread trigger iplayer stetus idead? Yes. thields in use? iyes. skip next iget clock value iget clock value ibit Ø to carry iven? Yes.	MOVXE2	BEQ MOVXE2   Game over? Yes. JSR TIMER   Idecrement time BPL GIP   Itime up? No. BTA TRAM+7   Sinutes display BTA TRAM+9   Sieconds display STA TRAM+10   Seconds display STA AUDIT   Seconds display STA AUDIT   Seconds display STA AUDIT   Second display STA CONTROL   Second disp
ÅISF	CMP TRIBB, X   compare shadow BEQ HITX   same? Yes. STA TRIBBS X   put shadow STA MISBLE, X   put shadow STA MISBLE, X   lensble missile CLC   close	MOVE2	STATE OF THE PROPERTY OF THE P	ionly 3263 Ishield sound Ivalue for Ishield volume Iread trigger Iplayer status Idead? Yes. Istrigger value Ishields in use? IYes. skip next Imove missile Iget clock value Ishield to carry Ieven? Yes. Itrigger, value	1 Comet	STA AUDC4   sound off  Mover Routine
ÅISF	CMP TRIBB, X   compare shadow BEQ HITX     same? Yes.   STA TRIBS, X     put shadow STA MISSLE, X     enable missile CLC	MOVE2	BY A SALE OF A S	ionly 3263 ishield sound ivalue for ishield volume ivalue for ishield volume iread trigger iplayer status idead? Yes. Itrigger value ishields in use? iyes. skip next imove missile iget clock value ibit Ø to carry leven? Yes. Itrigger value iwarp drive? iNo. skip next	MOVXE2	Mover Routine
	TXA Iplayer index BEQ MIS1 Iplayer #? Yes.		CMP #3 BNE MOVEX	ionly 32.63 Ishield sound Ivalue for Ishield volume Iread trigger Iplayer status Idead? Yes. X Itrigger value Ishields in use? IYes. skip next Imove missile Iget clock value Ibit Ø to carry Ieven? Yes. Itrigger value Iwarp drive? INO. skip next	1 Comet	PLA Inull X
	CMP TRIBB, X   compare shadow BEQ HITX     same? Yes. STA TRIBB X   put shadow STA HISBS.E, X   put shadow STA MISBLE, X   lenable missile CLC   LDA XPLR, X   ship X coord ADC & 2 STA OLDCRL		BY A SELECTION OF THE PROPERTY	ionly 3263 ishield sound ivalue for ishield volume iread trigger iplayer status idead? Yes. Itrigger value ishields in use? iyes. skip next imove missile iget clock value ibit Ø to carry ieven? Yes. X trigger value iwarp drive? iNo. skip next	819	PLA spull X TAX smove Acc to X
	TXA ;player index BEQ MIS1 ;player @? Yes. r Ø is target	Joyst	CMP #3 BNE MOVEX		1 Comet 1 1 G19	PLA spull X TAX smove Acc to X
	TXA   player index BEQ MIS1   player #7 Yes.  r # is target		CMP #3 BNE MOVEX		1 Comet 1 1 G19	PLA   pull X   TAX   Smove Acc to X   LDA HINC   Comet H speed AND CLOCK   Mask with clock BEQ BIP1   move comet? Yes.
	TXA   player index BEQ MIS1   player #7 Yes.  r # is target	Joyst	CMP #3 BNE MOVEX		1 Comet 1 1 G19	PLA   pull X   TAX   Smove Acc to X   LDA HINC   Comet H speed AND CLOCK   Mask with clock BEQ BIP1   move comet? Yes. PLA   restore Acc   res
	TXA   player index BEQ MIS1   player #7 Yes.  r # is target	Joyst	CMP #3 BNE MOVEX tick Handler LSR STICK, BCS MOVED, DEC YPLR, LSR STICK, DES MOVED	warp drive?   No. skip next   No. skip next   Stick up? No.     Hove skip up   Check joystick	1 Comet 1 1 G19	PLA   pull X   TAX   sove Acc to X   LDA HINC   comet H speed AND CLOCK   mask with clock BEQ 8191   mestore Acc   return   LDA COMETF   comet status
Player	TXA NASCA, Iplayer index BEQ MIS1   Iplayer 87 Yes.  r # is target  LDA XPLR   Ienemy X coord ADC #2   Iship center STA NEWCOL   Ideatination X LDA YPLR   Ienemy Y coord JMP MIS2   Iship next	Joyst HOVE2X	CMP #3 BNE MOVEX tick Handler LSR STICK, BCS MOVED, DEC YPLR, LSR STICK, DES MOVED	warp drive?   No. skip next   No. skip next   Stick up? No.     Hove skip up   Check joystick	1 Comet 1 1 G19	PLA   pull X   TAX   sove Acc to X   LDA HINC   comet H speed AND CLOCK   mask with clock BEQ 8191   mestore Acc   return   LDA COMETF   comet status
Player	TXA   player index BEQ MIS1   player #7 Yes.  r # is target	Joyst	CMP #3 BNE MOVEX tick Handler LSR STICK, BCS MOVED, DEC YPLR, LSR STICK, DES MOVED	warp drive?   No. skip next   No. skip next   Stick up? No.     Hove skip up   Check joystick	G199 G199 G199	PLA   pull X   TAX   sove Acc to X   LDA HINC   comet H speed AND CLOCK   mask with clock BEQ 8191   mestore Acc   return   LDA COMETF   comet status
Player	TXA BEQ MIS1   player index BEQ MIS1   player 0? Yes.  F o is target  LDA XPLR   lenemy X coord ADC 02   ship center STA NEMCOL   Idestination X LDA YPLR   lenemy Y coord JMP MIS2   skip next  T 1 is target	Joyst HOVE2X	LSR STICK, BUS STICK,	X Icheck joystick Istick up? No. Istick up? No. Istick down? No. Istick down? No. Istick down? No. Istick down Iget ship type IQID rocket? Yes. X Icheck joystick	G199 G199 G199	PLA   pull X   TAX   sove Acc to X   LDA HINC   comet H speed AND CLOCK   mask with clock BEQ 8191   mestore Acc   return   LDA COMETF   comet status
Player	TXA BEQ MIS1   player index BEQ MIS1   player 0? Yes.  F o is target  LDA XPLR   lenemy X coord ADC 02   ship center STA NEMCOL   Idestination X LDA YPLR   lenemy Y coord JMP MIS2   skip next  T 1 is target	NOVEL	LSR STICK, BUS STICK,	X Icheck joystick Istick up? No. Istick up? No. Istick down? No. Istick down? No. Istick down? No. Istick down Iget ship type IQID rocket? Yes. X Icheck joystick	G199 G199 G199	PLA   pull X   TAX   sove Acc to X   LDA HINC   comet H speed AND CLOCK   mask with clock BEQ 8191   mestore Acc   return   LDA COMETF   comet status
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next    X   Check   joystick     stick   up? No.     stick   up? No.     stick   up?   up     stick   up   up   up   up     stick   up   up   up   up     stick   up   up   up   up   up     stick   up   up   up   up   up   up     stick   up   up   up   up   up   up   up   u	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NORTH PLANT TO THE PROPERTY OF THE PROPERT	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA
Player	TXA NEWCOL Player index BEQ MIS1   player #7 Yes.  F # is target  LDA XPLR   lenemy X coord ADC #2   lenemy X coord JMP MIS2   lenemy X coord JMP MIS2   lenemy Y coord  LDA XPLR   lenemy X coord ADC #2   lenemy X coord ADC #4   lenemy X coord	MOVED MOVEL	LEG MPLEX LICK HANDLE X BUS MPLEC X LOS MPLEX LOS MPLEX LOS MPLEX LOS MOLEX	No. skip next   No. skip nex	G19 G19 G199 G198 G198	PLA

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ORA ###8
STA PCOLR3
CLC
LDA HPOS
ADC HDIR
STA HPOSP2
STA HPOSP3
STA COMETF
                                                                                                                                                                                                                                Ibrightness 8
Iplayer 3 color
Iclear carry
Icomet H coord
Iadd H direction
Inew H coord
Iplayer 2 H pos
Iplayer 3 H pos
                   Benerate Comet Sound
                                                                                                                                                                                                                                  Icomet and freq

Igame status

Igame over?

Igame over?

Igame over?

Igame over?

Igame over?

Ino. akip next

Ifreq/2

Iset frequency

Iset frequency

Iset frequency

Iset volume

Iset volume

Iset volume

Iset over to X

Igull Y

Imove Acc to Y

Igull Acc

Ireturn
                                                                                                                                      CSOUND
ENDBAM
GIS
CSOUND
6125
A
A
AUDF1
#$18
GI2
#$9F
AUDC1
GIS
                   Joystick Trigger Processor
                                                                                                LDA STRIB, X | get trigger | LSR A | Sove to carry | LDA TRIB | trigger option | AND DEAD, X | ship status | CHP TRIBN, X | same as last? | SEG TRIBZ | Yes. skip next | STA HITCLR | STA HITCLR | Strig option |
   TRIBR
 TRIBX
   TRI82
                   Missile Mover Routine
                                                                                                 MMX
                                                                                                                                DELTAR, X jadd delta Y
ROWAC, X jto Y Acc
ROWAC, X jto Y Andpoint
ROWINC, X jto Y Acc
ROWAC, X jto Y Acc
ROW
HHE
MM1
MMP
                                                                                                 ACASD LSLLBPLDSPDSLABLBTPLLASLDBAADEDPTR
 HHP1
HHØØ
HMØ1
 HHØ3
                   Erase Current Shot
                                                                                                LDA 66 iget zero value

BTA MISSLE, X [kill shot

TYA isave Y to Acc

HAA isave Y

LDY 63 lod 4 bytes

LDA (GRPM), Y iold shot pic

AND MISMSK/X ierase shot

STA (GRPM), Y jreplace pic
 MME
NME 2
```

	DEY BPL LDA AND		Inext byte Idone? No. Icmp collisions W/all but own		BNE LDA STA STA	YPLR	all done? No.   init Y coord of   ship   1
	BEQ	MME3 SCOREM	iscore point? No.		TYA		iship 2 iget zero
HME3	PLA TAY RTS	BLUKEN	linc score ipuli Y imove Acc to Y ireturn	PLA1	STA STA STA	PMØ.Y	liero missiles Iplayer Ø+1 Iplayer 2+3 Inext byte
1		1			INY	PLA1	inext byte ipage done? No.
Initia	lize	Playfiel	d		JSR	RANFIL	lauf astaraids
i				PLA11	LDX	XSTRT.X	ido 2 players
PLAYEM	JBR	AUDOFF	turn and off clr collisions		BTA	HPOSPØ, X	Iship X start
	LDA	##FF	value for		BTA	XPLR, X	land shadow Inext ship
		DEAD	sahip 1 alive		BPL	PLA11	idone? No.
		DEAD+1	Iship 2 alive Ivalue to		BTX	COLOR2	imake it a one
	STA	MMIEN	ienable URI's		STX	TEMP+1	Izero temporary
	BTA	TEMP+2	Ipages to zero		LDA	##2E BDMCTL	Ivalue for 'SP/M enable
	LDA	# <dram< td=""><td>idisplay addr lo</td><td></td><td>BTA</td><td>COLORI</td><td>ibright orange</td></dram<>	idisplay addr lo		BTA	COLORI	ibright orange
	LDA	UKPAUL	Idisplay potr lo Idisplay addr hi		LDA	# >PM PMBABE	set up P/M "
	BTA	BRPAGE+1	idispla potr hi		LDA		base address
		# >PMM BRPM+1	IPM addr hi		BTA	BRACTL	senable P/M
		##21	IPM pointer hi Ivalue for		STA	##C4 PCOLR#	igreen for ifirst ship
		BPRIOR	smulit-color PL		LDA	##34	ired/orange for
	LDA	AUDF4	lengine sound Evalue for		LDA	PCOLR1	Becond ship DLI addr lo
	STA	SIZEP2	idouble width		STA	VDSLST	IDLI potr lo
		SIZEP3	Icomets enabled Igame on		RTA	W >BIBR	IDLI addr hi IDLI pntr hi
	LDA	#99	! max score value		LDA	OTSPR	IDL addr lo
	BTA	SCORES	Iplayer 1 Iplayer 2		BTA	SDLSTL	IDL potr 10
2	LDX	#24	leove 25 bytes		SIA	SDLSTL+1	IDL potr hi
PLA3	LDA	TRAMI,X TRAM,X	Ifrom TRAMI		LDA	##CØ NMIEN	Ivalue to
	DEX		Ito TRAM Idec index	1	BIH	MUTEM	tenable DLI's
		PLA3	Idone? No.	Bame	Loops	Here, Lo	ops Here
	BTA		Iplayer addr hi Ipntr hi byte				
		SCRCLR	iclear inverse	ASHIFT	JSR	LDGRRT	set up painters
		81ZEM	ivalue for imissile sizes		BCC	TEMP+1 ARTØ	iget saved carry ibit #1=0? Yes.
	LDA	**	iget zero		LDA	(BRPABE)	.Y iget byte
		HPOS FLASHF			DRA	##8#	iset high bit Iclear carry
	STA	COMETF	scomet flag		BCC	ART2	takin next
	STA	ATRACT BCLOCK	jattract möde jscore sound	ART# ART2	LDA ROR	(BRPABE)	Y iget byte Irotate right
	STA	MISSLE	taissile & flag		STA	(BRPAGE)	Y ireplace byte
	BTA	MISSLE+1	missile 1 flag   zero Y index		INY	ARTS	inext byte
PLAØ	STA	(BRPABE)	Y sern byte=#		INC	BRPABE+1	ipage done? No. linc page addr ldec page count
	INY	PLAS	Y secre byte=#		DEC	TEMP+2	idec page count ipages done? No.
	INC	BRPAGE+1	ipage done? No. ido next page		LDA	*PAGES	spages to rotate
		TEMP+2	Ipage count		BTA	TEMP+2	put someplace

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```
Juniv flag
Jinverse? No.
Iflash flag
Iflash on? No.
Iflash screen
Idecrement count
Igame over flag
Igame over 
                                                                                                                                                                                                                 LDA # <ASTL | area to mift
STA SRPAGE | gr pntr lo
LDA #PABES | + >ASTL | hi addr
STA GRPAGE+| | pr pntr hi
DEY
LDA (GRPAGE) | dr pntr hi
ROL A
STA (GRPAGE) | V | get graphic
ROL A
STA (GRPAGE) | V | replace byte
TYA
DNE ALF1 | Jdec hi addr
DEC TEMP+2 | dec page count
BNE ALF1 | pages done? No.
ROL TEMP+1 | save carry bit
STA GRP1 | Jzerolow bytes
STA GRP2 | Jof these three
STA GRP2 | Joge zero pntre
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                UNIVERSE OF THE PROPERTY OF TH
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BCS TRY5
BTA VDIR
DEC VDIR
LDA RANDOM
TAN #61
LSR A
DEX
BPL TRINC
LDA #648
BTA AUDCI
LDA RANJF
LDA RANJ
            ALF1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         TRYA
                                                                                                                                                                                             BRPAGE+1

DEC TEMP+2

Idec page count

BRPAGE+1

Idec page count

Idec pag
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      FL1
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ROR A
BCC SC9
LDX #4
LDX #4
EOR COLORØ, X
STA COLORØ, X
DEX
BPL REVØ
DEC REVF
RTS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              Ireverse flag
icheck bit 9
izero? Yes.
ido colors 9..4
iflip brightness
( jof colors
( ireplace values
idecrement index
idone? No.
iclear flag
ireturn
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          SCRCLR
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REVØ
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Frandom coin!
Frandom coin!
France speed
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    ORA#
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                LDA RANDOM
AND #$JF
BNE COMET
JSR REVSCR
LDA #$1F
STA FLASHC
STA FLASHF
BNE COMET
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      TRYFLA
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Imake #..63
Ido flash? No.
IYes. flash scrn
Iyalue for
Iflash count
Iflash flag
Icontinue
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     RELOC
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    ORA2
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BEQ COMETX
LDA COMETF
BEQ TRYCOM
JMP ASHIFT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |comet flag
|comets? No.
|comet on flag
|on? No.
|continue
DRAS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      COMETX
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        *= $62E# ;RUN address .WORD RELOC+$1666
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          random number
imake #..63
lenable? No.
lcomet H speed=#
linitialize X=#
lclr players 2+3
ldecrement index
ldone? No.
lzero players 23
lhorizontal pos
lzero comet snd
lrandom number
imake #..3
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      TRYCOM
ORA4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  TRYØ
                                    Inverse Universe Handler
FLASH
                                                                                                                                                                                                             ROR A #START -> carry
BCC FL# #START pressed?
JMP PLAY8M #Yes. restart
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              TRY5
```

Some program listings reproduced in ANALOG may contain "strange" characters not shown on the Atari keyboard. These are special characters which use the CTRL, ESC and "ATARI LOGO" (IN-VERSE) keys. Shown below is a list of these characters and the keystrokes used to get them.  $\square$ --- CTRL --- INVERSE CTRL M └ --- CTRL Z --- INVERSE CTRL N --- CTRL A ₹ --- ESC ESC T --- INVERSE CTRL O --- CTRL B + --- ESC CTRL UP-ARROW --- INVERSE CTRL P CTRL C + --- ESC CTRL DOWN-ARROW --- INVERSE CTRL Q CTRL D + --- ESC CTRL LEFT-ARROW --- INVERSE CTRL R → --- ESC CTRL RIGHT-ARROW --- INVERSE CTRL 5 • --- CTRL . --- INVERSE CTRL T --- CTRL G + --- CTRL ; --- INVERSE CTRL U --- CTRL H K --- ESC SHIFT CLEAR --- CTRL I --- INVERSE CTRL V 4 --- ESC BACK 5 CTRL J --- INVERSE CTRL W # --- INVERSE CTRL W # --- INVERSE CTRL X + --- ESC TAB CTRL K C --- INVERSE CTRL , --- INVERSE CTRL Y CTRL L | --- INVERSE CTRL A L --- INVERSE CTRL Z CTRL M ■ --- INVERSE CTRL B 0 --- ESC DELETE CTRL N 🛂 --- INVERSE CTRL C --- ESC INSERT CTRL 0 # --- INVERSE CTRL D --- ESC CTRL TAB (CLR) --- CTRL P 7 --- INVERSE CTRL E --- ESC SHIFT TAB (SET) --- CTRL Q INVERSE CTRL F INVERSE SPACE --- CTRL R V --- INVERSE CTRL G --- INVERSE --- CTRL 5 🔻 --- INVERSE CTRL H CTRL T --- INVERSE CTRL . F --- INVERSE CTRL I CTRL U 🖸 --- INVERSE CTRL ; **▼ --- INVERSE CTRL J** ı --- CTRL V | --- INVERSE | L --- INVERSE CTRL K --- CTRL W --- ESC CTRL 2 ■ --- INVERSE CTRL L --- CTRL X [ --- ESC CTRL BACK 5 --- CTRL Y --- ESC CTRL INSERT

ARCHON II: ADEPT by Anne Westfall, Jon Freeman and Paul Reiche, III ELECTRONIC ARTS 2755 Campus Drive San Mateo, CA 94403 48K Disk \$39.95

# by Patrick J. Kelley

When the original **Archon** first made its debut in early 1983, I was convinced that I had found the ideal computer game. **Archon** combined chess strategy with hard-driving action. It offered an exciting challenge to jaded video-jocks who wanted a little thought with their shoot-'em-ups, and vice versa.

Only a pile of battered joysticks survive, mute witnesses to my devotion to **Archon**, along with a few fond memories of pitched battles shared with fellow devotee Tom Hudson. My feelings for this game run deep, so it was with mixed emotions that I received the news that Electronic Arts was considering a "sequel" of sorts, **Archon II: Adept.** I awaited the arrival of the game here at **ANALOG Computing**, joystick in hand and breath bated.

# The age of Archon.

In Archon II, the lines of battle are drawn: the minions of Chaos face off against the forces of Order for the control of the material world. The battle takes place in each of the four elements—air, earth, fire and water. The principle combatants are mages (or sorcerers of each Demesne or Dimension) and their Demons or Elementals, summoned by each to slug it out. Only when all six power points on the board are secured—or your opponent runs out of energy—is the game over.

You also have a trump card: the doomsday spell of Apocalypse, where a single sorcerer meets his opposite number in a fireball-throwing fight to the finish. The real emphasis of **Archon II** is power, magical power. And herein lies this new version's major weakness.

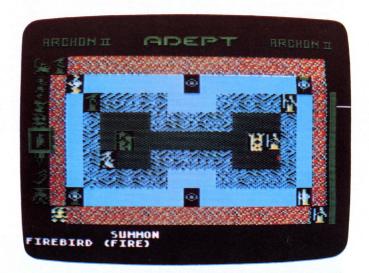
# Power and prey.

In Archon II, your primary obstacle to overcome when doing combat is your expenditure of magical energy. At the beginning of each game, both sides have a limit of energy to expend in combat, be it in spells to hobble your enemy or in power used to summon elemental "troops" into combat to remove an opponent.

Power can be maintained only by careful budgeting or successful occupation of your dimensional power points. Thus, you're not battling individual pieces as you were in the original **Archon**, where victory depended on your skills in attrition against your opponent's pieces. Instead, you are battling "power," a

concept I feel falls flat when compared to the original. Surgically eliminating pieces cannot give you the same gain as in the earlier version, let alone the satisfaction of splattering an enemy to the four winds (or, in this case, elements).

In this respect, Archon II is more strategy oriented . . . and slower. Attrition here can be brought about by forcing your opponent to deplete his pool of power, replacing pieces or casting spells. Your advantage is to grab power points as soon as possible, using as little energy as possible to dig in. Pitched battles are still possible using this strategy, but usually they don't come until later in the game.



# Archon II: Adept.

However, if things are going badly for you in the strategy phase of the game, there is still the Apocalypse spell waiting, either to save or damn you. In calling for Apocalypse, you and your opposite decide the outcome with well-placed shots. The two solitary pieces square off on a symbolically fiery battleground and have it out. The object of the Apocalypse is to hit the other guy hard, fast and continuously—until he ceases to be, buys the farm, checks out, goes belly up, etc. In other words, if you can outgun your adversary and withstand his assaults on you, you emerge as **Archon** Master, ruler of all you survey.

## All's fair?

In discussing the Apocalypse segment of Archon II: Adept, I am bound by my duty as fair and impartial reviewer to comment on a built-in "cheat" that favors the computer when you take up arms against it. In Archon II, not only is the computer a more ruthless player than in Archon, but it has gained the ability to steer its shots against you when it chooses an Adept as a playing piece. Although you, too, have this ability, virtually no amount of practice will give you the lightning-fast response time that the computer has. This, I feel, is stacking the deck too much in favor of the machine-enemy.



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There is one pointer that I *can* give you. The computer's homing missiles or fireballs aren't functional on a battlefield where there is natural cover or a place to hide. Use this to your advantage to snipe at the computer, or as shelter from its deadly shots.

# The ending is yours.

In the final accounting, **Archon II: Adept** is a fine game. With the exception of the two features that I found personally annoying, I cannot fault the game. Conceptually, it is still a winner, and the playability is superb. **Archon II** has great entertainment value, with the added plus of giving an old classic a new twist.

I think that, in time to come, players are bound to develop new strategies, fresh tactics and more efficient ways to give the computer its just desserts. But, in the meantime, I foresee many strained friendships, long marathon sessions and many a case of "joystick thumb." Electronic Arts, you've done it again.  $\square$ 

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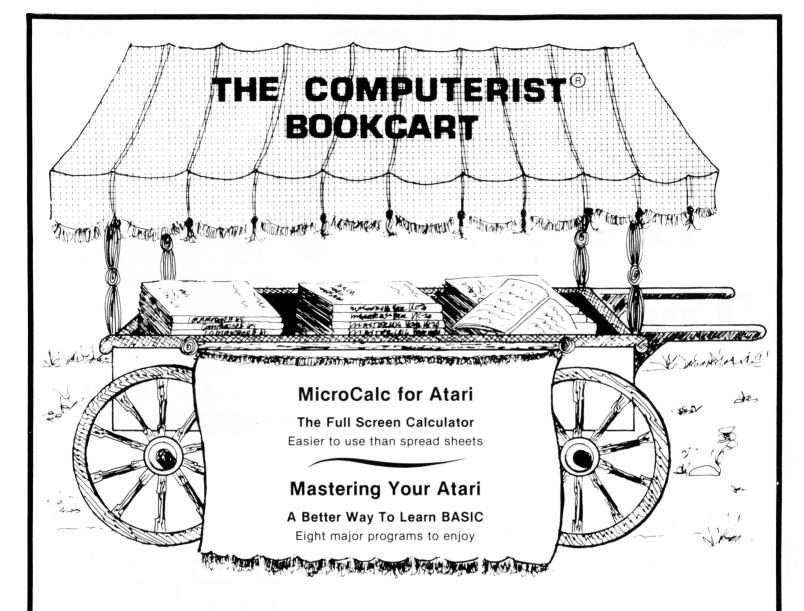
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# BASIC Training



# by Tom Hudson

So, you want to write BASIC, do you? Well, you've come to the right place. This is **BASIC Training** (also known as "My Game"), and we're in the process of writing a simple little game originally called **Battle-ship**.

## What's in a name?

This game's been around in one form or another for years, all the way back to the forties, when it was played with paper and a pencil by two players.

But let's face it, this is the computer age, and, as long as we're going to have our Atari computers play this game, we might as well update the name. From now on, it will be known as **High Seas**.

As we all know, the name alone doesn't make a game fun or challenging. You've got to invest the *time* to make it fun. That's just what we're going to do, starting right now.

Last issue, we looked at the general flowchart for **High Seas**. This time, we're going to describe the major data elements used by the program.

# What's where?

In order for the computer to be able to play **High** Seas (or any other game), we must represent the game board in memory, in a way that allows the computer to play.

The first data area we'll set up is that for the game boards. Figure 1 shows the **High Seas** game board layout.

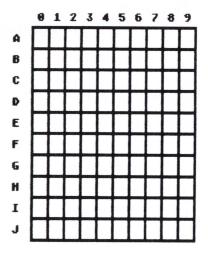


Figure 1.

In **High Seas**, there are actually two game boards, one for each player. In our application, one is for the computer, the other for the human player. Otherwise, the boards are identical.

If you've done any BASIC programming at all, you'll see that these game boards are ideally suited for computer representation. Each of the boards is simply a two-dimensional matrix with ten rows and ten columns. In Atari BASIC, we could define a game board with the statement *DIM BOARD*(9,9). We only dimension the matrix with *nine* rows and columns, be-

cause the computer can reference the zero element, also. The only thing the computer has to do is change the A-J row labels to 0-9 internal matrix indexes, as in Figure 2.

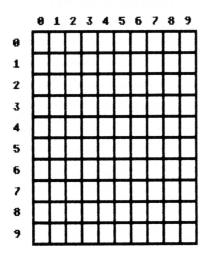


Figure 2.

In the game, we'll have two separate game boards, one for the computer's ships (we'll call it CG0) and one for the human player's ships (we'll call it HG0).

That was simple enough, right? Now, whenever we refer to the computer's board location "G4," the computer will think of it as CG0(6,4).

Each of the game matrices (CG0, HG0) will contain codes indicating what type of ship is placed in each location of the board. More on that in a moment.

As the game proceeds, each player will take turns "shooting" at the other player's ships. It will be necessary to record which locations on the board have been shot at, in order to prevent shot duplication. Naturally, your first impulse is to set up another matrix for this purpose, but that's not going to work here. Let's see why not.

In a numeric matrix, like CG0, there are 100 separate elements, numbered from CG0(0,0) to CG0(9,9). Each element requires 6 bytes of memory, so the entire matrix requires 600 bytes.

High Seas requires five ten-by-ten matrices in order to work. I have already mentioned CG0 and HG0, the ship placement arrays. There are also two arrays for shot recording, and a fifth array for the computer's shooting routine. If each of these matrices is set up as a numeric matrix, together they will require 5\*600 or 3000 bytes! Take it from me, there's no way High Seas would fit in a 16K system if the work areas were defined this way. There would simply be no room for the artificial intelligence routines.

How are we going to do it, then? We'll use strings for the shot recording matrices. If strings are used, these two data areas will only require 200 bytes, instead of 1200 bytes. This simple action alone saves 1000 bytes!

We'll call the shot recording areas CG1\$ (computer grid shots) and HG1\$ (human grid shots). Each of these strings is 100 bytes long, each byte representing a position on the grid. A zero in any position means that the location has never been shot at. A one indicates that a shot was taken, and it was a miss. A two indicates that a shot was taken, and it was a hit. Figure 3 shows how the grid positions are represented in computer memory.

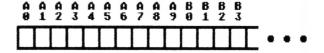


Figure 3.

In order to point to the proper position of CG1\$ and HG1\$, the program has to calculate a pointer from the two indexes of the game board. The equation needed to do this is:

## POINTER = INDEX1\*10 + INDEX2 + 1

For example, the computer's board position B3, held in CGO(1,3), would be calculated as:

# 1 \* 10 + 3 + 1 = 14

After calculating the pointer, we would simply examine CG1\$(14,14) and see what it contained. The matrix position (0,0) would result in a pointer value of 1, and the position (9,9) gives a pointer value of 100.

The calculation of string indexes takes somewhat longer than the equivalent matrix operations, but the memory savings are more important than speed. After all, you can make a game fast, but what good does that do if it won't fit in your computer?

# The ships.

As mentioned last issue, **High Seas** is played with five types of ships. These are: destroyer (2 units long), submarine (3 units), cruiser (3 units), battleship (4 units), and aircraft carrier (5 units).

Now, computers are not very smart. Unless you set things up just right, they can't tell one ship from another. That's why we're going to assign each type of ship a specific numeric value. Figure 4 lists each ship and its number.

1 = DESTROYER

2 = SUBMARINE

3 = CRUISER

4 = BATTLESHIP

5 = A-CARRIER

Figure 4.

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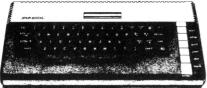
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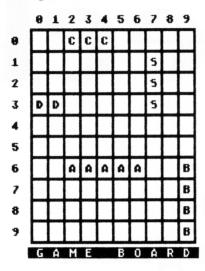
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The ship numbers will be used in the CG0 and HG0 matrices. Each position in the matrix will contain a number reflecting the contents of that square on the game board. If the square is empty, the matrix location will contain a zero. If the square has part of a ship on it, the matrix location will contain the number of that ship. Figure 5 shows a typical computer ship setup and the contents of the CG0 array for that configuration.



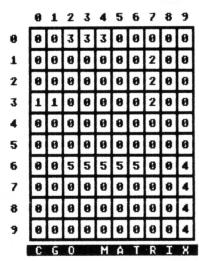


Figure 5.

As you can see, the two positions occupied by the destroyer are represented by two *Is* in the CG0 positions (3,0) and (3,1). All the other ships' locations are similarly marked. Empty squares are indicated by a 0.

Numbers are fine for the computer—after all, it spends its whole life working with them! Humans, on the other hand, just don't feel comfortable with numbers alone. If we're told that "ship 4" has been sunk, that doesn't mean much to us. No, we'd rather see the name of the ship.

We'll use a large string, SN\$, to hold the names of the ships in **High Seas**. By abbreviating the term

aircraft carrier to A-CARRIER, all the ship names will fit in ten characters. We'll set up SN\$ so that DES-TROYER is in characters 1-10, SUBMARINE in characters 11-20, and so on.

When we want to recall the individual ship names, we will calculate a pointer based on the ship number, as follows:

# POINTER = ( SHIP# \* 10 ) - 9

We then retrieve SN\$(POINTER,POINTER+9), and we have the ship name. For example, the name of "ship 1" can be found in SN\$(1,10); "ship 5" has its name in SN\$(41,50). Simple, right?

Of course, we'll have to initialize all our matrices at the beginning of our program, because Atari BA-SIC doesn't do this for us. The matrices will contain all sorts of random garbage, so we'll have to set them to zeroes with FOR-NEXT loops.

We'll also need to set up the strings we're going to use, such as SN\$. The CG1\$ and HG1\$ strings, used for shot recording, have to be initialized to blanks, indicating that no shots have been taken.

## All set?

Now that we've defined all of our data areas, we're ready to start coding, right? Wrong. We still have to flowchart the other major areas of the game, ship placement and shooting for both the human player and the computer. For next issue. . . the human's routines!  $\square$ 

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# Unicheck

# The Universal Checksum Program

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by Tom Hudson

Many of our readers currently use the D:CHECK2 and C:CHECK programs to find typing errors in the programs they enter from ANALOG Computing. Unfortunately, these checksum programs can be cumbersome to use. In an effort to simplify checking programs for typos, I have developed Unicheck.

This is a program which loads into your system at power-up time as a device, allowing you to generate a checksum table with a simple keyboard command. Your BASIC program stays in memory all the time, eliminating the annoying LIST and ENTER operations.

# Typing it in.

Before typing anything, look at the listings accompanying this article.

Listing 1 is the BASIC data and data checking routine. This listing is used to create both cassette and disk versions of **Unicheck**. The data statements are listed in hexadecimal (base 16) to conserve memory.

Listing 2 is the assembly language source code for Unicheck, created with the OSS MAC/65 assembler. You *do not* have to type this listing to use Unicheck! It is included for those readers interested in assembly language.

Follow the instructions below to make a cassette or disk version of **Unicheck**.

# Cassette instructions.

- 1. Type Listing 1 into your computer, using the BASIC cartridge and use **C:CHECK** to check your typing.
- 2. Type RUN and press RETURN. The program will ask:

# MAKE CASSETTE (0) OR DISK (1)?

Type 0 and press RETURN. The program will begin checking the DATA statements, printing the line number of each as it goes. It will alert you if it finds any problems. Fix any incorrect lines and re-RUN the program, if necessary, until all errors are eliminated.

3. When all your DATA lines are correct, the computer will beep twice and prompt you to READY CASSETTE AND PRESS RETURN. Insert a blank cassette in your recorder, press the RECORD and P buttons simultaneously and hit RETURN. The message WRITING FILE will appear, and the program will create a boot tape

version of Unicheck, printing each DATA line number as it goes. When the READY prompt appears, Unicheck is ready to use. CSAVE the BASIC program onto a separate tape before continuing.

4. You will want to load Unicheck whenever you're entering programs from ANALOG Computing, so you can check them for accuracy. To do this, rewind the tape created by the program to the beginning. Turn your computer OFF. If you have a 400/800/1200XL computer, be sure the BASIC cartridge is inserted. Press the PLAY button on your recorder and turn ON your computer, while pressing the START button. The computer will beep once. Hit the RETURN key, and Unicheck will load into your computer. The READY prompt will appear, and you're ready to type in your program.

## Disk instructions.

Type Listing 1 into your computer, using the BASIC cartridge. If you have D:CHECK2, use it to check your typing.

2. Type RUN and press RETURN. The pro-

gram will ask:

## MAKE CASSETTE (0) OR DISK (1)?

Type 1 and press RETURN. The program will begin checking the DATA lines, printing the line number of each statement as it goes. It will alert you if it finds any problems. Fix incorrect lines and re-RUN the program, if necessary, until all errors are eliminated.

3. When all DATA lines are correct, you will be prompted to INSERT DISK WITH DOS, PRESS RETURN. Put a disk with DOS 2.0S or DOS XL into drive 1 and press RETURN. The message WRITING FILE will appear, and the program will create an AUTORUN.SYS file on the disk, displaying each DATA line number as it goes. When the READY prompt appears, Unicheck is ready to use. Be sure the BASIC program is SAVEd before continuing.

4. You will want to load Unicheck whenever you're entering programs from ANALOG Computing, so you can check them for accuracy. To do this, place the disk containing the AUTO-RUN.SYS file in drive 1. Turn your computer OFF. If you have a 400/800/1200XL computer. be sure the BASIC cartridge is inserted. When you turn on your computer, Unicheck will load automatically. (Note: Unicheck will only work as an AUTORUN.SYS file. Do not try to load it with the Binary Load function.) The READY prompt will appear, and you're ready to type in your program.

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# Checking your typing.

Once **Unicheck** is loaded into your computer, it's ready to check the typing of your programs—anytime you want. After the program is typed in, just enter:

# LIST "U:"

This will print a checksum data on your screen. If you have a printer, you can enter:

## LIST "U2:"

This will print the checksum data on your printer. Let's see how to interpret the checksum data. Figure 1 shows a typical checksum data table.

```
10 DATA 34,455,234,22,55,38,93,45,114,
285,633,442,453,23,31,2957
160 DATA 82,94,64,73,347,199,287,84,15
6,368,59,40,98,9,342,2302
310 DATA 65,356,101,25,547
```

# Figure 1.

Each line of the program being checked has its own checksum value. If any characters in the line are incorrect, the checksum for that line will differ from the corresponding magazine checksum. The checksum data is organized so that there are fifteen checksum values in each line, with the sixteenth value containing the total of the checksums.

The line number of the checksum line tells which line number is first in the checksum group. In Figure 1, the first line checked in the first checksum line is 10. The checksum for Line 100 is 34. The checksum of the line after Line 10 is 455, and so on. The total of the checksums in the first group is 2957. The first line checked in the second checksum line is 160, and its checksum is 82. The first line checked in the third checksum line is 310, and its checksum is 65.

Let's assume that the checksum data in Figure 1 was listed in the magazine, and you typed in the program and checked it with **Unicheck**. Figure 2 shows an example of what the **Unicheck** output may look like if you have typing errors.

10 DATA 34,455,234,22,55,38,244,45,114,285,633,442,453,23,31,3108
160 DATA 82,94,64,73,347,199,287,84,156,368,59,40,98,9,342,2302
310 DATA 65,101,34,200

# Figure 2.

The first thing to do is look at the total of the values in the first line. If there are any mistyped lines, it is easiest to spot here. This value should be 2957, as shown in Figure 1. However, in the results in the **Unicheck** output, the total is 3108. This means that there is an error in the fifteen checksum values in this line. Comparing the individual **Unicheck** checksum values to the magazine values, we find that the seventh checksum is 244 in the **Unicheck** output,

but should be 93. This means that the sixth line after Line 10 has an error that must be fixed. Note the error and continue checking. The rest of the line is correct, so we go on to the second line.

Now we check the total of the second line. The total of 2302 in our **Unicheck** output matches the total in the magazine, so we can go on to the third checksum line.

The third checksum line is different from the others in that it only checks four lines. This is because it is at the end of the program, and the program did not have an even multiple of fifteen lines. The line is checked the same way as the others. As you can see, the checksum line total should be 547, but is only 200 in the **Unicheck** output. Looking at the **Unicheck** output, you will notice that there is one less checksum value (the 356 in the magazine checksum data). This means that the first line in the program after Line 310 is missing. The last checksum in this line is also incorrect. It is a 34 and should be 25. This means that the third line after Line 310 in the program is incorrect.

To summarize, there were three errors in the program we checked. Two errors were caused by typos, and the third appeared because of a missing line.

After all errors have been noted, make the necessary changes, re-LIST the program to "U:" or "U2:" and compare the **Unicheck** output to the magazine checksum data again. Simply repeat this process until all errors are eliminated. When you're finished, you'll have an error-free program!

# Some final notes.

I feel sure that users of ANALOG Computing's D:CHECK2 and C:CHECK will find Unicheck a much easier program to work with. There a few things to remember when using it, however.

Unicheck takes up about 400 bytes of memory. Some programs may be too large to load into memory with Unicheck present, and you'll get an ERROR-19. In these rare cases, you should use the less convenient C: or D:CHECK programs.

Don't worry about pressing RESET when **Unicheck** is loaded. It will remain safely installed until you turn your machine off (or type DOS in a disk system—see below).

For disk users, typing DOS will remove Unicheck from memory. This is a necessary precaution with DOS 2.0S. The first time you type DOS, the computer will perform a system reset and remove Unicheck. Typing DOS again will take you to the DOS menu, as usual. If you return to BASIC, however, Unicheck will no longer be present.

Unicheck only works with programs from issue 10 or later. If it is used with programs before issue 10, incorrect checksum values will result. □

# BASIC listing.

```
10 REM *** UNICHECK ***
20 TRAP 20:? "MAKE CASSETTE (0), OR DI
SK (1)";:INPUT DSK:IF DSK>1 THEN 20
30 TRAP 40000:DATA 0,1,2,3,4,5,6,7,8,9
,0,0,0,0,0,10,11,12,13,14,15
40 DIM DAT$(91),HEX(22):FOR X=0 TO 22:
READ N:HEX(X)=N:NEXT X:LINE=990:RESTOR
E 1000:TRAP 120:? "CHECKING DATA"
50 LINE=LINE+10:? "LINE:";LINE:READ DA
T$:IF LEN(DAT$) <>90 THEN 220
60 DATLIN=PEEK(183)+PEEK(184)*256:IF DATLIN</br>
CALINE THEN ? "LINE ";LINE;" MISS
ING!":END
70 FOR X=1 TO 89 STEP 2:D1=ASC(DAT$(X.
70 FOR X=1 TO 89 STEP 2:D1=A5C(DAT$(X,
X))-48:D2=A5C(DAT$(X+1,X+1))-48:BYTE=H
EX(D1)*16+HEX(D2)
80 IF PASS=2 THEN PUT #1,BYTE:NEXT X:R
EAD CHKSUM:GOTO 50
90 TOTAL=TOTAL+BYTE:IF TOTAL>999 THEN
 100 NEXT X:READ CHKSUM: IF TOTAL=CHKSUM
   THEN 50
110 GOTO 220

110 GOTO 220

120 IF PEEK(195) (>6 THEN 220

130 IF PASS=0 THEN 170

140 IF NOT DSK THEN 160

150 PUT #1,224:PUT #1,2:PUT #1,225:PUT

#1,2:PUT #1,154:PUT #1,50:CLOSE #1:EN
 160 FOR X=1 TO 66:PUT #1,0:NEXT X:CLOS
    #1:END
170 IF NOT DSK THEN 200
180 ? "INSERT DISK WITH DOS, PRESS RET
URN";:DIM IN$(1):INPUT IN$:OPEN #1,8,0
"D:AUTORUM.5Y5"
 07A00160A20FB5209DD206CA10F8A9018DC206
60A20FBDD2069520CA10F860,623
1010 DATA A5CF8DCE06A5CE8DCF06A5CD8DD0
0620E206A99BAED106E002F014A20B8E4203A2
008E48038E49032056E48CC2,922
1020 DATA 0660AEB9069D0001EEB906AEB906
 E026F004C99BD0EBA20BBDAD069D0003CA10F7
A9008DB9062059E48CC206A2,164
1030 DATA 27A9209D0001CA10FAA99BBD2601
1939 DATH 27H7257V850BADF296859CADF396
859D4C74E449915789998195,596
1949 DATA 9928994E9999294154414499999
FFD8ADEC068DE7028580ADED,971
1060 DATA 068DE8028581ADF406850AADF506
 850BA000B91A03C900F005C8C8C8D0F4A90099
350BA000B91A03C700F005C8C8C8F0F4A70077
1B03A906991C03A955991A03,767
1070 DATA 4C00A008201206A9008DCD0685CD
85CE85CF85D085D1A9028DC1068DCC06A5218D
D106D00C08201206ADCC06D0,579
1080 DATA 03202D0620220628ACC206600885
D485D5201206A9008DBF068DC006A202D8A5D5
DDC306901D38FDC30685D5F8,303
1090 DATA ADBF06187DC6068DBF06ADC0067D
C9068DC0061890DBCA10D8AECC06F020A5D420
C7800C8801078DBCH18DBCHECC80F8Z8H3D428
4186A5D4C929D815A9908DCC,716
1100 DATA 86A98485CCA6CCBDBA06284106C6
CC10F4AEC186F8ADBF861865D885D8A5D16DC8
86298F85D1CAD8ECEEC186AD,748
1110 DATA C186C984D865A9818DC186A5D4C9
9BF8828228628ACC28668A5D81865CD85CDA5
D165CE85CEA5CF690085CFD8,530
1120 DATA A9008DCE06A5D18DCF06A5D08DD0
0620E206A92C204106A90085D085D1A9028DC1
 06EECD06ADCD06C90FD0B820,924
```

# CHECKSUM DATA.

(see page 90)

10 DATA 732,351,496,811,423,729,200,60 3,555,573,694,613,29,205,202,7216 160 DATA 760,198,962,645,494,30,155,40 7,655,57,955,761,507,330,782,7698 1070 DATA 842,694,121,189,33,986,181,9 79,141,22,300,108,149,971,5722

# Assembly language listing.

```
s .OPT NO LIST
JUNICHECK
JUniversal Checksum Program
           by Tom Hudson, July 1984
ANALOG Computing
       page zero equates
LEADØ
PRTIX
TOTLO
TOTMD
TOTHI
CHKLO
CHKHI
                                                                                                                                                                                                                                                                                                 *CB
*CC
*CE
*CF
*DØ
*D1
*D4
*D5
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        ;leading Ø flag
;# print index
;BCD chksum total
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        $ BCD checksum
       BYTE
BYTE2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        sincoming char
sincoming char
           zero-page setup pointers
       FROM
TO
           Program equates
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        Jeans init vector
Joos run vector
JOOS run vector
JOOS init vector
JOOS init vector
JOOS init vector
JOOS run 
CASINI
BOOT?
DOSYEC
DOSINI
ZICONOZ
LOMEM
PRTBUF
COLDST
MEMLO
DDEVIC
HATABS
                                                                                                                                                                                                                                                                                                 $#2
$#9
$#0
$#0
$2
$2
$2
$2
$4
                                                                                                                                                                                                                                                                                                     $80 0447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 00447 004
   ICCOM
ICBLEN
CIOV
SIOV
WARMSV
       This code is placed
then moved to page
subroutine access
                                                                                                                                                                                                          #= $9699
       UNICHECK entry table
                                                                                                                                                                                                      .WDRD 998 | spen file
.WDRD 998 | close file
.WDRD NDHAN-1
       ÚHTBL
UC
       UW
```

```
LDX #15
LDA ZIOCB, X | save the
STA ZIOBAK, X | calling IOCB
DEX
PL SZIOCB | data
PL SZIOCB | set up good...
STA MYSTAT | return status
RTS | land exit
LDX #15
LDA ZIOCB, X | restore the
STA ZIOCB, X | calling IOCB
DEX
BPL RZIOCB | data
RTS | land exit
    SAVE
SZIOCB
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          HILLINSIP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          BOTLOC
      print checksum line total
                                                                                                         LDA TOTHI
STA TOTØ
LDA TOTMD
STA TOTI
LDA TOTLO
STA TOTL
JSR JTOTL
LDA #155
                                                                                                                                                                                                                                                      set up chksum
sprint area with
stotal
    PLTOTL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            UNICHECK 'OPEN' code
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PHP
STA LCOUNT
STA LCOUNT
STA LCOUNT
STA TOTHD
STA TOTHD
STA CHKLO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            OPEN
                                                                                                                                                                                                                                                      sprint the amount sget CR...
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 $save proc stat
$zero out...
$line counter
$checksum total
                                                                                                     LDX OUTPUT | get output unit | CPX PRINTR | sprinter? | BEQ PRINTR | sprinter? | BEQ PRINTR | sprinter? | STA DDEVIC, X | STA PBUFIX | STA PRIBUF X | STA PBUFIX | STA DDEVIC, X | STA DDEVIC, X | STA DDEVIC, X | STA PBUFIX | STA DDEVIC, X | STA PBUFIX | STA PBUFIX | STA DDEVIC, X | STA D
        print char in A reg
    PBYTE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   ; checksum
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               jinit...
jmultiplier
jnew line flag
jget U1/U2 #
jl=scrn 2=printer
jOPEN done!
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              UNICHECK "CLOSE" code
    PRINTR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                PHP
JBR SAVE | ;save proc stat
LDA LFLAS | ;new line?
BNE ALDUN | ;yes!
JBR PLTOTL | ;print last tot.
JBR RESTOR | ;restore proc
PLP
LDY MYSTAT | ;set status
RTS | ;all done!
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            CLOSE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            ALLDUN
    PRNTIT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            RTS | sall done!

K "WRITE" code

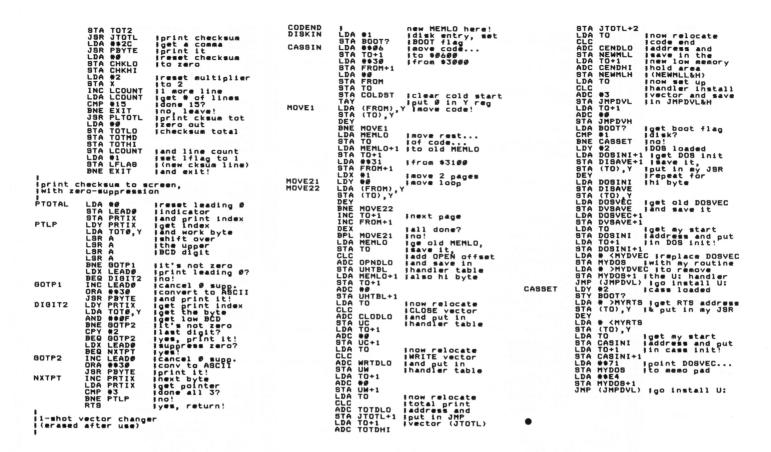
PHP
STA BYTE | save incoming |
STA BODBYT |
STA BODBYT | save incoming |
STA BODBYT |
STA BODBYT | save incoming |
STA BODBYT |
STA BODBYT | save incoming |
STA BODBYT |
LDA BODBYT | save incoming |
STA BODBYT |
LDA BYTE | save incoming |
STA CHALB |
LDA CHKLO |
LDA CHKLO |
STA CHKLO |
STA CHKLO |
LDA CHKLO |
STA CHKLO |
STA CHKLO |
LDA CHKLO |
STA CHKLO |
STA CHKLO |
LDA CHKLO |
STA CHKLO |
STA CHKLO |
LDA CHKLO |
STA CHKLO |
STA CHKLO |
STA CHKLO |
STA CHKLO |
LDA CHKLO |
STA CHC |
S
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            UNICHECK "WRITE" code
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            WRITE
  CPBUE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        BCDLP
    MYDVEC
    ; miscellaneous data
                                                                                                     aneous data

.BYTE $40 | printer
.BYTE $61 | init $1
.BYTE $67 | "W" = write
.BYTE $57 | "W" = write
.BYTE $68 | output
.WORD PRTBUF | buffer address
.WORD $28 | buffer length
.BYTE $42 | normal print
.BYTE $44 | normal print
.BYTE $46 | unused
.BYTE $60 | unu
    PCOMND
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        NXTDIB
  PBUFIX
PDATA
BCDBYT
    X
MYSTAT
DECTBL
BCDADL
BCDADH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        PDATLP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          NOTNEW
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        CKADLP
        JMP vector for subroutine
    JTOTL JMP #00 ; to PTOTAL
        Relocation factors
XOK
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          end of line, print checksum
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              LDA CHKLO
CLC
ADC TOTLO
STA TOTLO
LDA CHKHI
ADC TOTMD
STA TOTMD
STA TOTMD
LDA TOTHI
ADC ##
STA TOTHI
CLD
LDA ##
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 jadd checksum
ito checksum
itotal
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        ÉOL
      ;

¡This section is placed at $3100;

¡then moved down to the old

¡MEMLD location.
    install U: device handler
                                                                                                       JSR *FFFF jinit DOS
CLD
LDA NEWHLL
STA MEMLL
STA MEMLL
STA LONEM
LDA NEWHLH
LDA NEWHLH
STA HEMLO+1
STA LOMEM+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 $no more decimal
$put checksum in
$print work area
$(TOTØ-TOT2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    LDA #Ø
STA TOTØ
LDA CHKHI
STA TOT1
LDA CHKLO
```



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# An Interview with Free Fall Associates: Jon Freeman and Anne Westfall

# by Arthur Leyenberger

Anne Westfall and Jon Freeman are wedded partners. Not that it's uncommon for a married couple to consider themselves partners, but this partnership concerns computers, mainly software: video games.

Anne and Jon are principal members of Free Fall Associates, a game design and development group located in Portola Valley, California. You've probably heard of some of their games: Archon, Murder on the Zinderneuf, and the new Archon II: Adept, all published by Electronic Arts (a review of the latter appears on page 75). Each of these games is imaginative, fun to play on several levels and well implemented. With this in mind, the following chat with Anne and Jon was, for me, both interesting and very enjoyable. I hope that you'll enjoy it, too.

**AL:** Where did you get the idea for **Archon**?

**JF:** That came from a couple of different thoughts. For a long time I have wanted to do a fantasy chess game. This derived partly from a fantasy-oriented chess set I once saw. It had "Conan" pieces on one side and "Goblin" pieces on the other. The other source was a living chess game I once participated in.

People were dressed in armor and differently armed. They acted as the pieces, while two opponents called out their moves. When a piece moved into an occupied square, the two players had to fight it out for possession. This was done with fake swords, axes and clubs, and—since I was playing a pawn—all I had was a small shield and sword.

The first battle was a pawn-to-pawn battle, and I "killed" off the other guy. Another variable in the game was the fighting ability of each of the players. The two strongest players were a warlord (instead of a queen) and a knight. When I came up against this particular knight, I realized that, because of his ability and his equipment, I didn't stand a chance. So I thought that the least I could do was to "kill" him, in addition to him "killing" me. The battle was very short, and we ended up "killing" each other. This is where the notion of the "double-kill" in **Archon** came about.

**AL:** How long did it take to complete the **Archon** project?

**JF:** It took about six months, though

# Do you subscribe to ANALOG Computing on disk or cassette?

...if not, then you should.

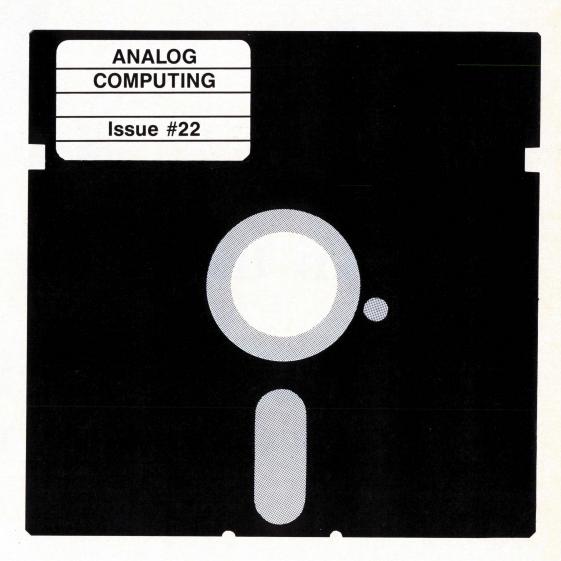
Since issue 1,

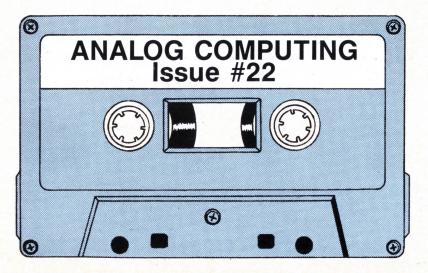
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we were working on it night and day. Normally a game like this should take about nine months.

**AW:** We had a deadline and we were determined to make it.

**AL:** I understand that one of you is the programmer, and one of you is the designer. Who is which, and how does that work out when creating a game?

**AW:** I am the programmer, and Jon is the designer. It is a little hard to generalize, but usually Jon comes up with an idea that he likes, then he discusses it with me to see if I like it and if it is technically feasible.

**JF:** Regardless of how practical the concept is, if Anne doesn't like it, then it becomes work. We'd rather have fun while we are working. Many times we go back and forth and talk with Paul (Reiche) about the concept until we've come up with a preliminary design. We then produce an outline of the game, and Anne takes that and does a program design and the programming.

**AW:** That is really an oversimplification. I would love to have a script to work from, but sometimes the script is evolving while I am actually doing the programming. What we call a script is nothing like a Hollywood script. It is not that detailed.

**AL:** It seems that there would have to be a lot of cooperation and role-changing. If Jon did just the design and Anne just the programming, Jon would have nothing to do for most of the time during the game development.

**JF:** That's right, so the way that it ends up is that she does all of the programming and program design, but most of the graphics work is done by Paul and I—because she simply does not have the time. We end up doing a lot of the little things, like shape design and sound effects.

**AW:** They will experiment with different sounds until they have something they like. The data, such as frequency and duration, is given to me, and I come up with a sound program that will create what they want. Their routines are typically written in BASIC, because it is quickly coded and easily changed. I do the conversion to assembly language, which is quite a bit different.

It is really a dynamic process as we are going along, because they will present an idea of what they want, and I will manage to get it working so that they can see the results. It may not work the

way they want it to. So we all sit back and decide what we really want, then come up with several alternatives. Some approaches may require more coding or be more appropriate for the particular game.

**AL:** In what ways did **Archon** finally turn out differently than what you first had envisioned?

**AW:** Only the tactical board turned out to be different.

**JF: Archon** turned out to be pretty much what we had wanted. We did a lot more adjusting with **Adept** than **Archon**. The look of the tactical board was a little nebulous at the beginning. We knew that we wanted a tactical board in which the players would fight, but we were also concerned that it be dynamic.

It is really a dynamic process... they will present an idea; I will manage to get it working so they can see the results. It may not work the way they want it to, so we all sit back and come up with alternatives.

We did not want people to just park the player and wait for the weaker piece or the piece that had to close. We ended up with the disappearing barriers so that nobody could just sit on the board. At one point, we were going to have stationary barriers and change the luminance of the background. It turned out to be a whole lot simpler to do it the other way around and change the colors of the barriers. Having disappearing barriers made the tactical board dynamic.

**AW:** Aside from that, it was mostly fine tuning, like adjusting the balance of the pieces. Unlike **Archon**, **Adept** changed considerably from start to finish. Almost the whole way the game is played—the strategy—is very different from what it was in the beginning. In fact, I don't remember what it was at first.

**JF:** It changed substantially. At the beginning, for instance, we started people out with a lot of energy, and it could not increase. We dismissed that idea pretty fast, because we felt that players wouldn't pay attention to their resources. They would spend, spend, spend, until they were almost out of energy, and only then start worrying about it. The energy you get from the different squares (the power points) was all the same, including the Void.

**AW:** Since the elemental power points would provide energy only when that element was active, every fourth turn, the Void was the only square that counted, since it stayed the same. Getting control of the Void was much more important than getting control of the corners, which wasn't what we had in mind.

What tended to happen was that, as it was so important, you would immediately put an Adept on the Void. Since it took two turns to get anybody else there, and you didn't want the other person getting that much energy, you'd immediately counterattack with an Adept. It ended up being a game of Adepts, attacking and counterattacking on the Void. The game would last five or six turns, and that would be it.

**JF:** We kicked around several possibilities, such as eliminating the Adepts or keeping them out of the Void, but we ...wanted to give players as many options as possible to build their own armies and use whatever strategies they wanted. We did not want to prohibit Adepts from going into the Void, so we came up with two changes.

One was to reduce the energy you got from the Void, so that it was less than the corners. This brought the overall game back into balance. The second change we made was to strip the Adepts of their advantage while in the Void. Normally, the Adepts' strength is determined in part from how far they are from their home citadel. By making the Void squares absent of magic, we ended up making the Adepts weaker. Then a player will not be so eager to move an Adept onto a Void square. Also, without magic, the Adepts cannot heal themselves in the Void and must be removed to get stronger. This is like pulling a piece back in chess; you really lose two moves.

**AL:** In Archon, there is a tendency for the inexperienced player to simply battle it out, without regard to strategy. In what other ways would you characterize

the differences between the expert and inexperienced player?

**JF:** With Adept, we have not had a chance to watch players as much as we would like to. From what we have seen, new players seem to do a lot of attacking, much of it not making too much strategic sense. Attacking for attacking's sake is not a particularly good longrange strategy.

As you learn the game, you tend only to put pieces on corners and the squares around the Void, which are strategically important positions. Secondly, you tend to avoid combat and use spells a lot. You have to watch your resources, and spells are used to either keep you from having to go to battle or to set up battles in favorable circumstances, like the Weaken spell. You also become more conservative as you realize that you don't have unlimited energy.

**AW:** There are two ways to look at the pieces in **Adept**. Some pieces are best viewed as placeholders or defenders, who just occupy a power point. Then there are the pieces that are good at attacking, which should not be wasted, like some of the Demons. Those are put on the board initially and then used to attack piece after piece. I think that new players to **Adept** will be less likely to slug it out than they were with **Archon**. Once they have played **Adept** one or two times, they will see the value of strategy.

**AL:** Jon, **Adept** is obviously a sequel to **Archon**. This is something fairly new in the game world. But I see you cringe every time the word *sequel* is mentioned. Would you explain how **Adept** is or is not a sequel to **Archon**?

**JF:** It is a sequel, in the sense that it was an attempt to do a game that would feel—sensually and emotionally—like Archon. The planning and pacing is similar. There are times when you sit back and think for a while. These are followed by periods of very intense excitement and action. Then you're back to thinking again. The mechanics such as the action board, strategy board, picking pieces and casting spells—are the same, so that someone who plays Archon can come in, pick up the game and start playing almost at once. So in these ways, it is a sequel. However, they will not be as good at Adept as they would have thought, because the pieces and strategy are so different. Also, the whole idea of resource or energy management is totally new.

**AL:** How do you see yourselves—as artists or as game designers—fitting into the overall cosmic scheme of things?

**JF:** On one level, I view myself as a game designer, and Anne sees herself as a program designer. But on another level, I think that entertainment and fun and games are an important thing, not just a fun thing.

**AW:** We were discussing this recently. There currently is kind of a slump in the software, and, as I look at it, the economy is doing fine. If you look back, when the economy was doing poorly and the whole world looked grim, the software business was doing great, because people need entertainment. Recreation is an important part of life. You have to have it.

If you look back, when the economy was doing poorly and the whole world looked grim, the software business was doing great, because people need entertainment. You have to have it.

**JF:** Doing games that people enjoy playing, that give them pleasure and exercise their mind, is a good thing. It is also the case that I have enough of the ex-teacher in me that there are things that I like to get across. There are certain kinds of philosophical, political or social things that would be nice to be able to influence people in. Some of it is subtle, and some of it is more overt.

The games we have been doing for Electronic Arts are not necessarily political in nature. When I wrote games for Epyx, the content was a lot more political and satirical. Many were libertarian, for instance. In our current games, there are both male and female characters. It is kind of a minor thing, and we are not really saying, "girls are okay, too," but the fact that there are male, female and neuter things in the games is important to us. That is why we put them there.

**AW:** "Artist" is a label that people seem to put on other people. It is not a self-imposed label. You don't walk around saying, "I have created a work of art." You don't know that, because art is a process of communication, and you do not know whether you've communicated with anybody. They do. If someone says that we have created a great game, then we have done a good job. We can't say that until we get feedback from people who play the games.

**JF:** Harlan Ellison once made a distinction between writers and authors that may be analogous. He said that real writers don't call themselves authors. That would be pretentious. An author is a person whose name is on the cover of the book. A writer is somebody who writes. If what we do can be considered a work of art, then by definition, we are artists. I don't think that is unreasonable.

**AL:** From what you have already said, you think that a person's beliefs come through in his or her work. To what extent do you think that a programmer's or designer's personality comes through?

**JF:** It is not nearly as simple as a one-to-one correspondence, but to a varying degree, it does. Things like humor or the type of violence in a game often reflect the personality of the people who created it.

**AW:** If you look at the difference between M.U.L.E. and Seven Cities of Gold, the personalities of Ozark's team comes through in different ways. In the first, their personalities come through rather directly. It is light, humorousalmost witty—and entertaining. Just look at the introduction screen and listen to that music. In Seven Cities, you don't necessarily see their personalities coming through visually until you play it. There is a signature, and when you are familiar with enough games from a particular group, you could line them up and say, "that was done by Free Fall, and that was done by Ozark."

**AL:** What would you ultimately like to achieve in your work, and what do you feel is the biggest constraint to doing that right now?

**JF:** There are three different things, two of which probably go together. We would like to be very successful commercially...to sell a lot of games to a lot of people. Partly because we would like to have a lot of money, but also to be able to continue what we are doing now.

I would also like to get recognition for doing a good job. That pretty much goes hand in hand with success. Apart from commercial success, I would like to do things that affect the way people think and how they look at the world.

**AW:** I would like to have people question things, rather than telling them that they should think this way or that ...have them question the way they themselves think and how they view the world. To broaden people's horizons.

**AL:** What do you see as the main constraint to doing that?

**JF:** The main constraint with the latter part is imagination. I have to come up with game designs that manage to be fun and entertaining, and, at the same time, have a point. Doing that is not easy, because I don't want to do things that are heavy-handed. They have *got* to be fun. You want to charm people into thinking about things differently, rather than beating them over the head with it

**AL:** Which game do you like better: **Archon** or **Adept**?

**AW:** It's hard to say. It's like having two children and asking which one you like better. But, having seen people playing **Archon** in tournaments, it became clear to me that I personally like a game with more strategy. Therefore, **Adept** would be my choice.

**JF:** I think I am still too close to them to have a favorite. If I actually had a clear favorite, in one place or another during the design I would have fallen down on the job. What I do is design games that I like to play and hope that other people will, too. I can't sell a game that only I like and, conversely, I can't work on a game that I don't like. That's too much like work.

**AL:** Can you talk about your next project?

**JF:** It's too soon to tell. We have a number of projects that we are considering, but none have reached the formal proposal stage. Part of it depends on machines. Whether we decide to do another Atari/Commodore game or maybe try something on the Apple MacIntosh, for example, is uncertain. The machines affect the type of game that you can do.

For instance, you can't really do a fourplayer game for the Mac. It's difficult enough to do that type of game for any of these other machines. The Mac is going to probably be a one-person game.

**AL:** Do you think that there are too many limitations with the existing lowend computers, such as hardware, processor type and speed, or installed base?

**JF:** It seems to us that there are an infinite number of good games which could be done on any of the currently popular machines. I wouldn't want to try to do a game for the VIC-20. It would be too limiting, but the Atari, Commodore and Apple provide the means for a lot of different possibilities.

**AW:** The machines' capabilities are not a problem, but the futures of the machines may be. We really like the Atari and have liked it for a long time. But it is really a question of what's going to happen with Atari and the Atari user. That raises questions about how long it will be feasible to do games for the Atari market. I will always have my Atari, though. □

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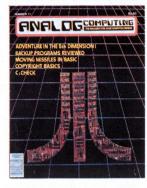
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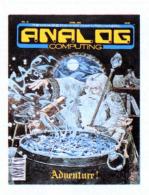
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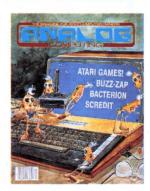
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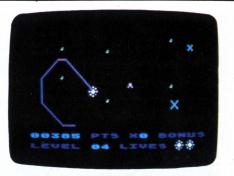
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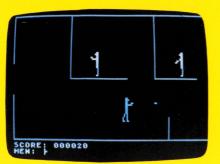
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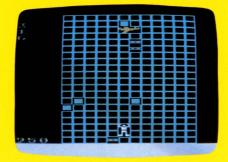








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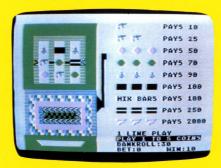
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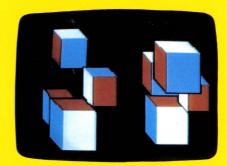
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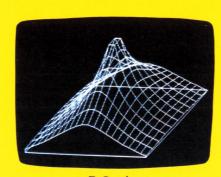


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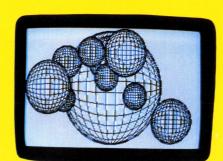
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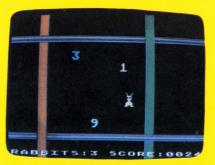
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